CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

Volume 19 San Francisco, January, 1933 Number 1

25c per copy

$1.00 per year

99443

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND GAME
San Francisco, California

Fish and Game Commissioners appointed by the Governor. Term at pleasure of Governor. No compensation

J. DALE GENTRY, President ..... San Bernardino
EARL B. GILMORE, Commissioner ..... Los Angeles
I. ZELLERBACH, Commissioner ..... San Francisco
JOHN L. FARLEY, Executive Officer ..... San Francisco
E. Lingenfelder, Assistant Executive Officer ..... Los Angeles
EUGENE D. BENNETT, Attorney ..... San Francisco

450 McAllister Street. Phone Underhill 8700

BUREAU OF FISH CULTURE

J. O. SNYDER, Chief ..... San Francisco
W. H. Shebley, Fish Cultural Adviser ..... Sacramento
J. H. Vogt, Assistant to Chief of Bureau ..... San Francisco
A. E. Burghduff, Field Superintendent ..... San Francisco
L. Phillips, Field Superintendent ..... San Francisco
E. V. Cassell, Superintendent of Mt. Shasta Hatchery ..... Mt. Shasta
Geo. McCloud, Superintendent Mt. Whitney Hatchery ..... Independence
D. A. Clanton, Superintendent Forest Home Hatchery ..... Forest Home
J. C. Lewis, Superintendent Fort Seward Hatchery ..... Alderpoint
Earl Leitritz, Foreman Fall Creek Hatchery ..... Copco
Peter Topp, Foreman Yosemite Hatchery ..... Yosemite
C. L. Frame, Foreman Big Creek Hatchery ..... Davenport
J. W. Ricker, Foreman Cold Creek Hatchery ..... Ukiah
H. E. Cole, Foreman Feather River Hatchery ..... Clio
Ed Clessen, Foreman Kaweah Hatchery ..... Three Rivers
George E. West, Foreman Tahoe Hatchery ..... Tahoe
Wm. Berrian, Foreman Lake Almanor Hatchery ..... Chester
L. C. Dockham, Foreman Basin Creek Hatchery ..... Tuolumne
Archie Thompson, Foreman Burney Creek Hatchery ..... Burney
K. H. Shebley, Foreman Kings River Hatchery ..... Fresno
Guy C. Tabler, Foreman Yuba River Hatchery ..... Camptonville
John Marshall, Foreman Brookdale Hatchery ..... Brookdale
James L. Stinnett, Foreman Klamath River Stations ..... Gottville
William Fiske, Acting Foreman, Mt. Whitney Hatchery ..... Independence
Ross McCloud, General Foreman Mt. Shasta Hatchery ..... Mt. Shasta
Donald Evins, Superintendent Distribution Car 01 ..... Mt. Shasta
L. Rider, Superintendent Distribution Car 02 ..... Mt. Shasta

BUREAU OF COMERCIAL FISHERIES

N. B. SCOFIELD, Chief ..... San Francisco
S. H. Dado, Assistant Chief ..... San Francisco
H. B. Nidever, Field Inspector ..... San Francisco
L. G. Van Vorhis ..... Terminal Island
W. L. Scofield, Director State Fisheries Laboratory ..... Terminal Island
W. F. Thompson, Consultant State Fisheries Laboratory ..... Terminal Island

BUREAU OF FINANCE AND ACCOUNTS

H. R. DUNBAR, Chief ..... Sacramento

BUREAU OF EDUCATION AND RESEARCH

LEO K. WILSON, Chief ..... San Francisco
Opie L. Warner, Publicist ..... San Francisco
Dr. M. Hobmaier, Pathologist ..... San Francisco
Paul A. Shaw, Toxicologist ..... San Francisco
Jack Boaz, Lecturer ..... Los Angeles
Bessie W. Kibbe, Librarian ..... San Francisco

BUREAU OF GAME REFUGES

J. S. HUNTER, Chief ..... San Francisco
Jay C. Bruce, State Lion Hunter ..... San Lorenzo
D. D. McLean, Field Naturalist ..... San Francisco
A. D. McLellan, Game Refuge Supervisor ..... San Francisco

BUREAU OF HYDRAULICS

JOHN SPENCER, Chief ..... San Francisco
Clarence Elliger, Assistant ..... San Francisco
E. A. Chan ..... Long Beach

BUREAU OF GAME FARMS

AUGUST BADE, Chief ..... Yountville
E. D. Platt, Assistant in Charge ..... Chino
Gordon H. True, Jr., Field Production of Game ..... San Francisco

BUREAU OF FISH RESCUE AND RECLAMATION

GEORGE NEALE, Chief ..... Sacramento

CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION."

VOLUME 19 · SACRAMENTO, JANUARY, 1933 · No. 1

TABLE OF CONTENTS

	Page
SOME FACTS ABOUT PREDATORY ANIMAL CONTROL—*Chas. G. Poole*	1
PARASITES OF FISHES—*Paul Bonnot*	9
THE MANAGEMENT OF DUCK MARSHES—*Leo K. Wilson*	15
THE QUAIL REPLENISHMENT PROGRAM—*Gordon H. True, Jr.*	20
NEW METHOD DEVELOPED FOR THALLIUM DETERMINATION—*Paul A. Shaw*	24
ROCK BASS (PARALABRAX) IN THE CALIFORNIA COMMERCIAL FISHERY—*Frances N. Clark*	25
THE BUREAU OF FISH CULTURE CONVENTIONS—*A. E. Burghduff*	35
THE LIFE HISTORY OF THE CALIFORNIA BARRACUDA AND ITS BEARING ON THE CONSERVATION OF THE FISHERIES—*L. A. Walford*	37
REPORT OF THE COMMISSIONERS OF FISHERIES OF THE STATE OF CALIFORNIA FOR THE YEARS 1870 AND 1871	41
EDITORIALS	57
LIFE HISTORY NOTES	62
DIVISION ACTIVITIES	64
REPORTS—	
Violations of Fish and Game Laws	71
Statement of Income	72
Statement of Expenditures	73
Fishery Products, July, August and September, 1932	76

SOME FACTS ABOUT PREDATORY ANIMAL CONTROL

By CHAS. G. POOLE, State Leader, Predatory Animal Control,
Bureau of Biological Survey

YEARS before the present term "predatory animal control" was adopted to denote an intensive and widespread effort to reduce the numbers of the predators committing depredations among domestic stock, poultry, and wild game, there had been rather extensive but unorganized action against both wolves and coyotes in parts of the West where effort was being made to develop the country. During earlier periods when buffalo, deer, and antelope were hunted by pio-

neers of the West, the gray wolf and the coyote also were taken in many sections as animals whose pelts had a market value, not great, but sufficient to make them objects of some considerable attention when the fur was prime, during the winter months.

Old-time trappers, hunters, and stockmen consistently maintain that before domestic stock and poultry entered into the picture the wolves, and to a lesser extent the coyotes, in Wyoming, Colorado, Montana, the Dakotas and other states, preyed extensively upon the game animals and birds. While the coyote was doubtless always a killer its role in the early days appears to have been largely that of a scavenger. As time passed it became evident that the two animals supplemented human slaughter in the depletion of the herds of buffalo, deer of several species, and the great bands of antelope that ranged over vast areas west of the Missouri River, especially through the Great American Desert country. They early discovered that a heavy annual toll was being taken of the young of these animals by wolves and coyotes, and because of this, greater activities developed in the destruction of the predators. While the fur was desirable when prime, because of the revenue, the matter of confining control activities to the season when the pelts had a commercial value was waived in many localities, and efforts were made to reduce the predatory animal population through the entire year, regardless of season.

In those days there were innumerable rodents in the West—rabbits, prairie dogs, ground squirrels, and pocket gophers—over most of the area to the Pacific Ocean, and most species are still abundant there. At no time does it appear that the coyote has applied itself to intensive pursuit of these animals or served in any manner as an appreciable control agent. It is true that the coyote undoubtedly did and does kill many rodents, especially jack rabbits, but it does not take them as a steady diet where there is a supply of other food more to its taste and requiring less effort to obtain. At certain seasons of the year the coyote eats a great many grasshoppers, but it can not be said to control the numbers of these insects any more than it does the rodents.

When domestic stock was introduced on the western ranges, and wild game, such as the buffalo had decreased in numbers almost to the point of complete extermination over large areas, wolves and coyotes turned their attention to the introduced food supply. They were not long in accepting this as an entirely satisfactory and easily obtained substitute, in many localities almost entirely disregarding their former diet. With each succeeding year wolf depredations upon cattle herds increased, until the losses in many instances became so great and the situation so acute as to present a problem compelling the stockmen to take drastic action. After many years of effort to control the predators by many different methods, the gray, or lobo, wolves decreased in numbers in most of the western states to an appreciable extent, and, except in a very few localities, they have now ceased to be a menace to the live stock industry.

Coyotes have always been scavengers and in early times helped to clean up the remains of animals that had been killed and only partially eaten by the wolf. For instance, in the hunt looking toward the elimination of the famous Custer wolf in South Dakota, it was noted in the study of this particular wolf and its mode of killing that it was invari-

ably accompanied by two coyotes who feasted upon its kill after the wolf had first satisfied its appetite. Studies indicate that the coyote has always been a potential killer in spite of its scavenger proclivities and in later years has developed into a predator of a class more nearly comparable to that of the wolf. This has been because the coyote is one of the most versatile and self-reliant of all mammals, having a knack of adapting itself easily and promptly to changed conditions. It seems to have developed a taste for the meat of domestic animals, adopting the general habits of the lobo as a killer and in some instances feeding upon domestic meat to the exclusion of that of the less readily obtained wild animals.

FIG. 1. A coyote.

Some of the drastic measures required in dealing with the lobo wolf apply in a lesser degree to its relative, the coyote. Changed conditions have caused the latter to gravitate from one mode of getting a living to another, but even so, the coyote may live out its life cycle without killing other than small animals and birds, such as rabbits, quail, and sage hens. On the other hand, it may develop a stock-killer complex from the time it is able to go out with its mother on the first hunt, and may almost immediately become a pronounced menace not only to wild but also to domestic animals. Any contention that young coyotes may be depended upon not to kill other than rabbits, mice, and ground squirrels is groundless. Close observation over a period of years has

proved that the pups of the year may within a short time raid flocks of turkeys and other domestic fowl, in many cases, killing more than they can eat, and that soon afterward they may turn their attention to lambs, young pigs, and, in some cases, young calves. In the main, however, environment controls the food habits of the coyote, and it may or may not have to be educated to take up a career of stock marauding.

In time, stockmen appealed to their state legislatures to place bounties upon wolves and coyotes, and this was done, with the main purpose of stimulating hunters and trappers to concentrate their activities on these pests. The bounty system, however, favored fraudulent practices that made good or lasting results impracticable.

A discussion of the relative merits or demerits of the bounty system as a satisfactory solution of the control of the coyote or other predatory animals can not be attempted here, but briefly the fact is that after years of trial of that system, predatory animals remained a most serious menace to the successful raising of live stock and poultry in most of the western states, including California. This situation was so bad in some localities that many small stock raisers were completely put out of business. This condition made their ranches practically worthless, as they were of value only for raising cattle and sheep. The consequence was that their property, in many cases acquired after years of hard work and hardship, had either to be abandoned entirely or used for something for which it was unfitted, with disastrous financial results.

In addition to this phase of the predatory animal problem there have been sporadic outbreaks of rabies among wolves and coyotes. The question of whether rabies was first passed from dog to wolf or coyote or vice versa is debatable. The fact remains, however, that from time immemorial the coyote and wolf have been a reservoir of infestation and means of transmitting this disease. It is doubtless reasonable to assume that at the present time dogs may be responsible in numerous cases for the transmission of rabies to coyotes and wolves because a greater number of dogs are now at large than in earlier days when the population, particularly of the western country, was confined to small settlements and isolated stock ranges.

It is unnecessary here to dwell upon the character and effect of this malady other than to say that not only does the coyote suffer from its devastations, but also seldom does any living thing bitten by a rabid coyote escape. In some instances thousands of dollars worth of domestic stock have been lost. Still worse, human lives are sometimes endangered, and all living things are menaced in any territory where this disease breaks out. As a result of the control of coyotes, outbreaks are not so frequent now as they were in many localities where they had been of annual occurrence. It follows that, for this reason alone, if for no other, the coyote population should be kept under control.

Because of a serious outbreak of rabies among coyotes in California and Nevada in 1915, which resulted in great losses among live stock and even the death of human victims, the aid of the Federal Government was solicited, after efforts of stockmen and state agencies had failed to cope with the situation. In response to this appeal, Congress gave the Biological Survey the task of reducing the coyote population, and this has been undertaken to a reasonable and justifiable extent from the economic and public health standpoint.

The intensity of individual work against wolves and coyotes for many years had hinged upon various things. Possibly the fluctuations of the fur market had the greatest bearing upon the intensity of the trappers' activities, low prices causing a slackening up in trapping and poisoning. Sporadic intensive campaigns of destruction had been initiated by stockmen in certain localities in the stock-raising states when the activities of the predators had become unbearable. But, because of lack of coordination and rational planning, these efforts had produced only temporary relief in comparatively small areas.

The early use of poison is of significant interest, especially in view of criticism of its use in the control of predatory animals. The use of strychnine for killing wolves and coyotes had long been general and unrestricted. Hunters and trappers used it extensively, and practically every ranchman, whether a stock raiser to any extent or not, had at all times supplies for poisoning carcasses of dead cattle, sheep, horses, and buffalo wherever and whenever killed or found dead. In general, proper precautionary measures were not used in its placement and little if any thought was given to what might be the result to harmless and valuable fur-bearing animals. Predators in many places became "wise," owing probably to the crudity of methods employed and sometimes only animals for which the poison was not intended were killed.

The use of poisons along these lines was general and it continued, regardless of poor results, until the application of the present-day careful and systematic procedure developed by the Biological Survey. The unrestricted use of strychnine in a haphazard and crude way by irresponsible and careless individuals was curtailed as a result of information disseminated by the Biological Survey and cooperating agencies engaged in cooperative animal-pest control. While strychnine is employed under certain conditions in the control of predatory animals, a system of restricted distribution has been adopted by the Biological Survey and the method now used, after years of experimentation, results only in a very small mortality among harmless species of mammals and birds.

Other methods of control, such as trapping, shooting, running with dogs, and periodic so-called drives have been and still are used. The first two of these, especially trapping, have been found to have advantages, under proper planning and management, and are generally successful. Shooting is a valuable method as opportunity is afforded, but running with dogs has little to recommend it. Coyote drives have no value whatever and have not been used by the survey. Conditions continually make it necessary to supplement some one of these by one or more of the others. Trapping is the predominant method, but there are times when even the use of traps is impracticable because of the peculiarities of the animals to be captured or because of excessive cost. No one method is infallible, hence no one can be used to the exclusion of all others.

Poisoning as now employed, is considered the most efficient and economical method of control where conditions are suitable. In virgin territory the results are immediate and thorough, and require the least expenditure of effort, money, and time. In localities where ranchmen and others use poison promiscuously, immediate success with it is not

so certain and its use is questionable, but when it is employed in accordance with the procedure developed by the Biological Survey and under careful supervision, the percentage of mortality among fur bearers is often less than is the case with trapping. Investigations have shown that the decrease of furs reaching the market is due not so much to poisons placed for predators as to overtrapping; and a shortage of furs on the market when fur animals are plentiful is due to the slumps in prices of raw furs that make it unprofitable for the commercial trapper to operate.

FIG. 2. A badger. Photograph taken by E. S. Cheney.

Trapping, however, is nearly as effective as poison in the control of predators in many sections, especially well settled regions where they are not very abundant. It is used by the Biological Survey to a far greater extent than any other method, and to the exclusion of poison where possible. This system has some drawbacks, and under certain conditions may be a greater menace to nonpredatory animals than poison when properly used. However, trapping has become the standard method and will probably continue to hold its rank for all time.

Rifles and other firearms in predatory animal control are used in conjunction with the other means. Shooting as a method by itself fails from an economic standpoint as being impractical and inefficient. As an adjunct to some other method, however, its value can not be overestimated.

The employment of dogs alone for the control of such predators as the wolf and coyote is one of the most useless and unsatisfactory of all methods. It has been tried untold numbers of times, both in the old days and also in more recent years, but it has invariably been supplanted by more satisfactory methods. The running of coyotes and

wolves with dogs has been and still is mainly a sporting proposition indulged in by a few for the sport and excitement that can be had, rather than for any profit there is in it or for any real accomplishment from the control standpoint. In controlling predators of the cat family, however, the use of dogs is practical and eminently successful, and will probably remain the most economical and efficient method as long as dogs love to chase cats, and cats are afraid of dogs.

Den hunting during the proper season has played a large part in the control of wolves and coyotes and has been employed for many years, especially where bounties have been offered. Unfortunately, however, instead of destroying the mother, it was the custom quite generally for bounty hunters to let her live so that there might be an annual crops of pups on which to get bounties in succeeding years. If den hunting is carried on in an honest manner, so as to effect a complete clean-up, it is obviously an efficient and relatively inexpensive method of control. Every pup is a potential killer, even though conditions may be such that not all develop into this class.

The fundamental aim of the Biological Survey and its cooperators in this work is reasonable and justifiable control, and not eradication, and all control campaigns are planned and carried out with this in mind. General eradication of coyotes is neither desirable nor possible. There are vast areas where the coyote is in no sense a serious pest, and what control is necessary may well be left to the activities of the fur trapper. During the 10-year period that rather intensive predatory animal repression work has been carried on in parts of California, this policy of control has been in effect; and, instead of indiscriminate, thoughtless, and unnecessary campaigns, investigations have been made of all requests for aid. The intensity of this work hinges upon the economic factors involved, and, in some localities, upon the amount of damage being done to harmless and beneficial wild animals and birds. When there appears to be no reason to inaugurate a control program—in other words, when there is little marauding by predators among stock and poultry, and the mortality from this cause among game animals and birds is normal and only what could reasonably be expected in the natural relations of wild life—no attempt is made to interfere with coyotes or other predators.

There is not one of the 58 counties in California but that has coyotes or other predators in greater or lesser numbers. Of the 58 counties mentioned, predatory animal control is carried on in 30 with varying intensity by the Biological Survey and its cooperators. These 30 counties have within their limits the majority of the approximately 4,000,000 sheep of the State. In addition to this class of stock there are other domestic animals, including poultry, that suffer from the activities of predatory animals.

In the northern part of California there was a serious loss annually among the mule deer and the few remaining antelope prior to the inauguration of control work. The value of these animals can not be questioned, and their protection from predatory animal depredations is certainly warranted. The increase of the Mount Dome herd of antelope from less than 100 in 1920 to a conservative estimate of 400 is due in large measure to the elimination of many coyotes and bobcats from their range. There are still enough coyotes throughout the

State to satisfy the craving of those who like to hear their morning and evening serenades and enough to furnish a reasonable supply for the commercial trapper.

The contentions of many stockmen and sportsmen that far too little predatory animal control is being undertaken for the welfare of the game, doubtless have considerable merit and should receive consideration. Careful investigation, however, of conditions surrounding all areas where control is desired should always be made to determine whether operations are justified and to what extent they should be carried on.

The control work of the cooperating agencies in this State has netted a total of approximately 41,000 predatory animals, an average of 4100 a year for the 10-year period. This is in an average of 24 counties, less than half the total number in the State. It would appear, however, that a very small part of the coyote population has been touched, and the maintained average from year to year indicates that at the most only the annual increase is being kept up with, if indeed control goes even that far. Certainly there is no threat of extermination. The greater part of the annual catch is made in September, October, and November, and it is during these months that the majority of complaints of depredations are reported. As the number of coyotes decrease during these months, so also the number of complaints of depredations decrease. Because of limited funds control is confined to an extent that only relieves the situation in certain regions for a temporary period, and leaves untouched vast areas that are natural breeding grounds and safe harbors for predators.

Other predatory animals, such as the cougar, bobcat, and an occasional predatory bear, are less numerous and constitute less of a menace to the economic fabric than do the wolf and the coyote. Cougars and bobcats, however, are to be seriously considered in the conservation of game animals and birds, and to a somewhat lesser degree, in the protection of live stock and poultry. Bobcats are especially active among young lambs at certain seasons of the year, and at these times attempt is made to keep their numbers down so that they may constitute no more than a normal hazard. The bear in the main is a harmless animal, one that needs little attention from the control standpoint, but there are individuals, now and then, that unquestionably develop the killer complex and do much damage, especially to sheep. Before control work is started against such individuals, reports of depredations receive careful investigation.

The necessity for the control of predatory animals, both past and present, is admitted by those who are familiar with the relationships between predators and domestic stock, poultry, harmless and beneficial wild animals, and game birds. The intensity of the control and the methods to be employed in its attainment are subjects of some controversy, and it is probable that there will continue to be decided differences of opinion along these lines. It should be noted, however, that present-day methods of control, which afford protection to forms of wild life that are harmless or valuable from an economic or esthetic standpoint, have brought about a decided improvement over the hit-or-miss practices formerly in vogue.

It is possible to carry on selective control on a given area to a considerable extent by carefully choosing the methods to be employed. Though no system can be considered 100 per cent perfect, that adopted succeeds in reducing the mortality among harmless mammals to a very appreciable extent. The general policy outlined differs widely from the methods employed when stockmen, farmers, and others each poisoned and trapped according to his own ideas. Under the supervision of the Biological Survey and its cooperators, however, this policy is in force at this time and is being rigidly adhered to.

PARASITES OF FISHES

By Paul Bonnot

THERE are few organisms which are not parasites at some time in their lives. For this reason it is difficult to draw a hard and fast line between parasitic and nonparasitic animals. Even man, who considers himself the last work of natural creation, passes his uterine existence as a true parasite, and after birth becomes, for a time, an ectoparasite. No species of animal is free from parasites, and probably no individual animal is for long free from parasites. The flesh of most species of marine food fish is notably free from parasites. There is no reason to believe that any of the parasites of our marine food fishes, can develop in any of their stages of existence in man. It should be understood that all danger from infection by parasites that occur in food is completely removed by thorough cooking.

In this paper we will consider only the entozoa of fishes. Entozoa is a term used to designate any animal that lives inside another animal. The animal in which an entozoön lives is called the host. When the parasite lives as an adult the host is called the final host and when the parasite lives as a larval form the host is known as the intermediate host.

The entozoa of fishes fall into four main groups; cestodes (tapeworms), nematodes (roundworms), trematodes (flukes) and the acanthocephalids (spinyheaded worms).

Parasites have their place in the economy of nature, helping in the elimination of the unfit and furnishing a certain amount of food for other animals in return for a medium of distribution. Very rarely does the parasite actually kill the host, as that would of course mean the death of the parasite. A heavy infection, however, will weaken the host either by mechanical means or by draining too heavily the food supply. In either case the host's chances of escaping its predatory enemies are lessened and it is more easily caught. This is sometimes to the advantage of the parasite which may need another host for the completion of it's own life cycle. Parasites encysted in the tissues of other animals sometimes number many thousands and as far as we know have the same nutritive value as any other animal tissue. As an example a cestode which is confined in the adult stage to one or two species of sharks or skates can have for intermediate hosts as many

as 30 or 40 species of teleosts, or bony fishes. Most of these intermediate hosts are small fishes such as smelt, mackerel, and herring and a great many larger fish eat them. Albacore, sea bass, mackerel, halibut and barracuda which have obtained to a fair size must have taken in along with their food a great many encysted tapeworms which have been digested completely with as much profit to the consumer as the rest of the tissue surrounding them. As the different cestode cysts can resist the digestive juices of only a few species which are their natural hosts it is in these only that it is able to live successfully. Among fishes the sharks and skates are the chief hosts of adult cestodes. To quote Linton (1912) "if the sharks and skates were to be exterminated almost the entire list of encysted parasites in the flesh and on the viscera of the bony fishes would cease to exist." (The viscera of an animal is the organs contained in the body cavity.)

The entozoa lead very specialized existences and their survival depends on an immense discharge of reproductive cells. As an example, when a tapeworm loosens a segment of it's body, which passes out with the fecal discharge of the host, many hundreds of eggs are liberated. These float about in the water and are swallowed by small fishes that feed on minute crustacea and small larval forms. Having gained the interior of the small fish, the eggs hatch and the resulting larvae burrow into the lining of the intestine, encyst and again are ready to be eaten. Here the chances are much against the worm. Only one or two species of fish are suitable as a final host. If the intermediate host in which it is now encysted is eaten by any other species of fish the worm dies, but if the intermediate host is swallowed by the right fish the worm foregathers with his kind and in due time starts sending out it's quota of eggs. Some species of trematodes require two intermediate hosts before they can return to the final host. One host, in these cases, is generally a vertebrate, one a mollusc and the third an insect. The cycle is generally arranged so that each host is part of the natural food supply of the succeeding one.

Trematodes

Triploblastic animals; bilaterally symmetrical; single gastrovascular cavity; no anus, presence of coelom doubtful. The ectoderm is nonciliated and suckers are present.

The trematodes or flukes are found both as external and internal parasites. They occur in all parts of the alimentary canal and its branches such as the bile ducts and liver. While very numerous, sometimes occurring in great numbers in a single fish, they are rarely met with outside of the body cavity. The life history of most of the trematodes involves the use of an invertebrate, usually a mollusc as an intermediate host. There are also several distinct stages of larval growth in some flukes. From the eggs of the adults ciliated embryos emerge which bore into the body of the intermediate host usually some form of water snail. Having gained entrance they lose the cilia and become an irregular mass called sporocysts. From the sporocysts there emerge tiny wormlike animals provided with a mouth, a pharynx and a straight intestine. These are called rediae. They invade the liver of the host. In each rediae there is developed a number of young flukes, differing from the adults in having rudimentary reproductive organs. Like the

adults they have the oral and ventral suckers and a forked intestine. These small flukes are called cercariae. The cercariae leave the intermediate host by way of the anus and place themselves in the way of the final host so that they may be swallowed or they may go with the intermediate host into the alimentary canal of the second intermediate. In the latter case, having found their way into the alimentary canal of the right species of animal the cyst is dissolved and they come to maturity. A typical case of a trematode life cycle is the so-called salmon poisoning contracted by dogs in northern California from eating raw salmon or steelhead trout. The name of this fluke is *Nanophyetus salmincola* and it is microscopic in size. Its normal host is some fish-eating bird. From the bird it goes into a water snail and having completed the necessary development goes into the body of a fish where it encysts. The fish is eaten by a bird and the worm comes to maturity in the bird. The worm has found a tolerant environment in dogs but the dog is not the natural host as witnessed by the fact that the infected animals almost invariably die.

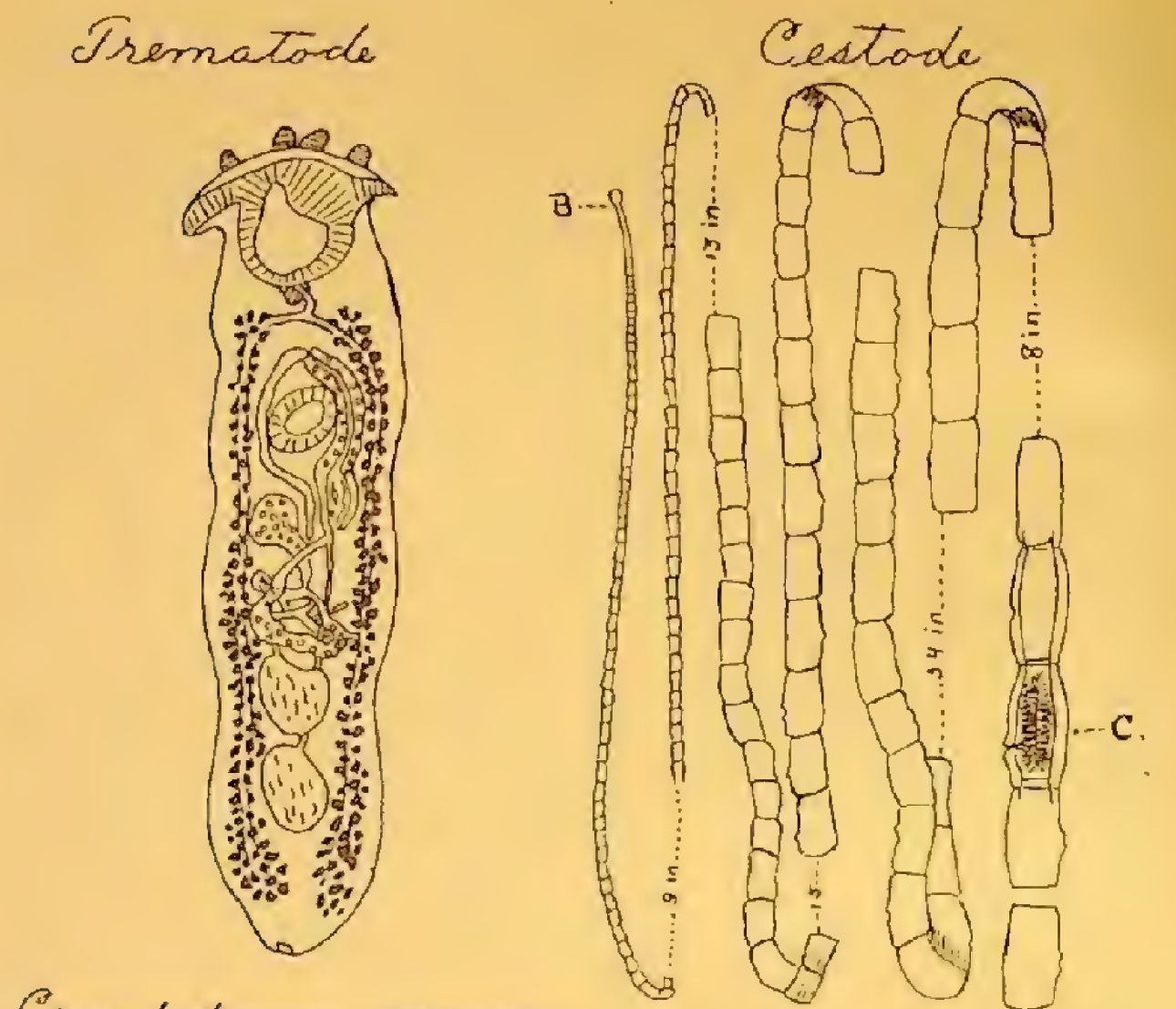
Cestodes.

Cestodes or tapeworms are flattened worms which cling rather loosely to the walls of the alimentary canal by means of hooks and suckers. A short neck next to the head is followed by a string of proglottides (segments) which gradually increase in size from the anterior to the posterior end. The worm has no mouth or alimentary canal, the digested food of the host being absorbed through the body wall. The proglottides are separate units each containing the complete male and female reproductive apparatus and are practically filled with reproductive products when they become ripe, break off and are carried into the outside world. The life cycle has already been described.

Nematodes

Bilaterally symmetrical, tripoblastic animals with an elongated cylindrical body; alimentary canal has a mouth opening at the anterior end and an anal opening on the ventral surface near the posterior end, and lies in a body cavity, which is probably a coelom; no cilia present in any part of the body; both free living and parasitic; sexes separate.

Nematodes may be recognized by their movements in a liquid medium. They continually coil and whip about without appreciable progress though they can progress if in a situation which offers something to push against. Parasitic nematodes occur in nearly all water living vertebrates. Young nematodes are very common in the viscera of fish but are rarely found in the flesh. The adults for the most part are also found in the alimentary canal but some species occur in the connective tissue and a few rare types may appear in other parts of the body. The encysted worms are larval forms. They go through a regular parasitic cycle. The young embryos in most cases enter the body of another animal, through the alimentary canal, burrow through the lining of the stomach or intestine and after encysting wait for their host to be eaten so that they may again enter the alimentary canal of the same species of animal from which they came. Nematodes are very resistant to digestive juices and are more to be feared than either trematodes or cestodes. The possibility of eating nematodes encysted in fish, however, is very remote. A much greater risk is taken in eating pork which sometimes carries the dreaded *Trichina*.



Crepidostomum cornutum
Ventral view; compressed.
×20 (After Osborn)

A Taenia saginata the tape worm (after Camb. Nat. Hist.)

B Taenia solium, Scolex (after Shipley and MacBride)

C. Sexually mature perglottid of Taenia

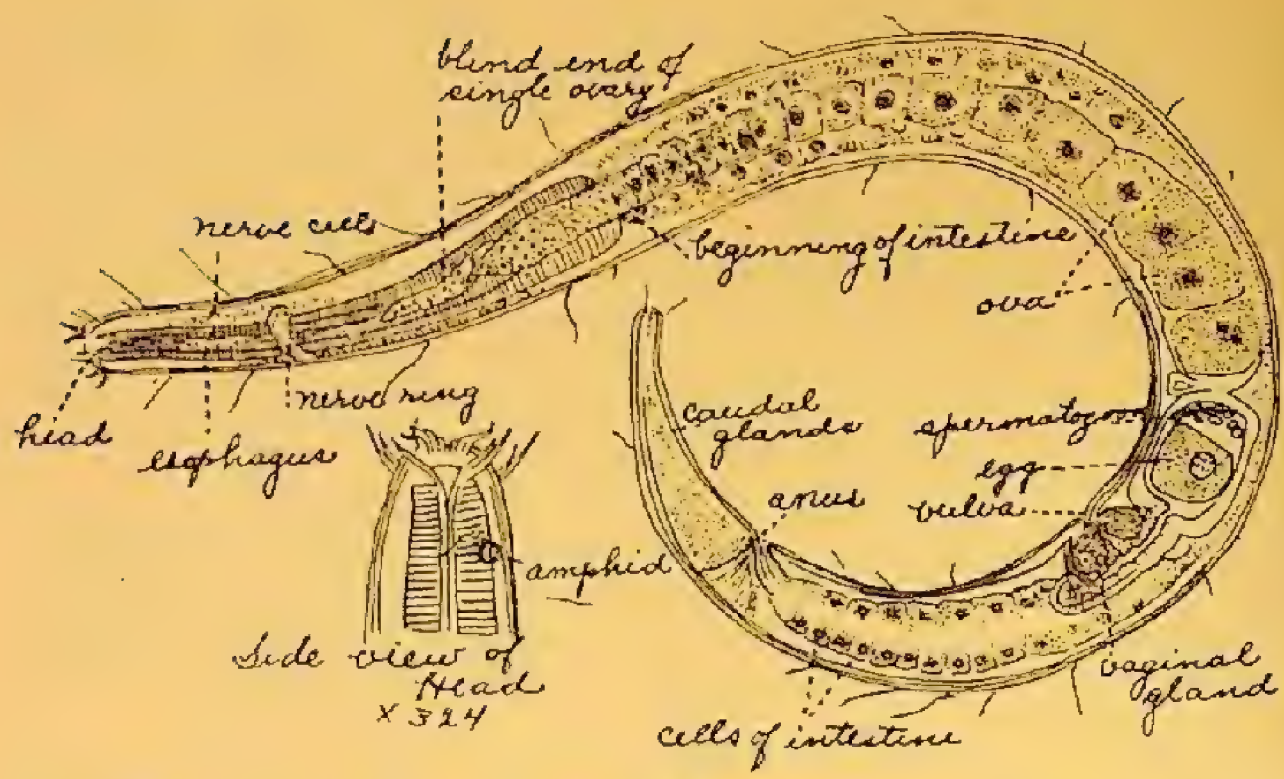
FIG. 3.

Acanthocephala

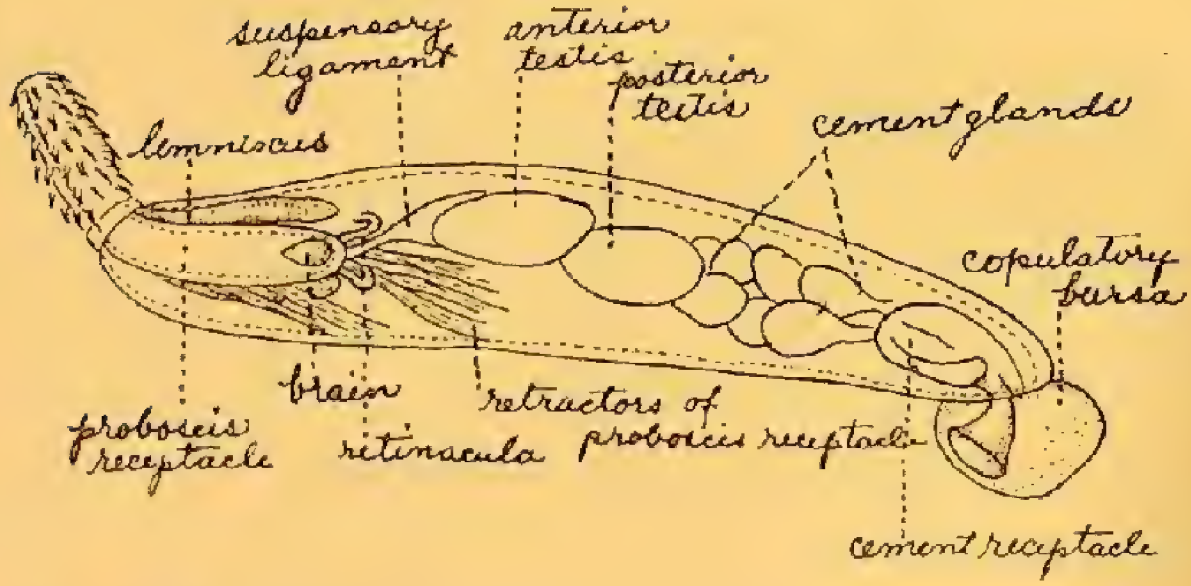
The acanthocephala are a group of formidable parasites which are not so numerous as the other classes. A proboscis which is covered with hard little hooks, a complex reproductive system and an absence of the alimentary canal distinguishes them from the nematodes and trematodes. They require a final and intermediate host. In the adult stage the head is thrust through the intestine and is generally surrounded by a waxy material produced by the breaking down of the surrounding cells of the host. The anatomy of these worms has been worked out in some detail but not much is known concerning their life histories. They are found in the adult stages in nearly every known vertebrate, including man. Among fish the striped bass seems to offer an exceptionally favorable environment as there are few of these fish that do not harbor some of these worms.

It would be hard to find a subject which interests the general public more than the question of food and drink. On this subject, however, "a little knowledge is a dangerous thing." Any individual who ballyhoos some erroneous prejudice regarding food and its chemical or bacteriological content can always obtain a hearing and sometimes, sad to relate, belief.

It will be seen from the foregoing that practically all the entozoa live their lives in one host and must go through their development in one or more intermediate hosts. The adults in nearly all cases live in the alimentary canal. The young parasites burrow through the walls of the alimentary canal and come to rest in the body cavity, in one of the visceral organs or more rarely in the muscle tissue. In cleaning fish, therefore, the parasites are disposed of in nearly all cases with the removal of the viscera. Occasionally small white cysts will be found along the backbone of fishes. This is the result of the activity of a sporozoan, a protozoan organism. As these cysts are confined to the vertebral region the removal of the backbone will remove practically all of them. Now and then tiny nematodes will be found in the muscle tissue in the vertebral region and are removed in the same manner. As has been pointed out the hosts which furnish a favorable environment for adult stages of the entozoa are very limited. A tapeworm which inhabits the spiral valve and intestine of the hammerhead shark, for instance, can not live in the adult stage in the alimentary canal of any other fish or shark. With the single exception of the European broad tapeworm (*Dibothriocephalus latus*), which is of rare occurrence on the east coast of the United States, there is no known entozoa, from fish, that has ever succeeded in living in humans. Inasmuch as the practice of eating our fish raw is not very prevalent, and as cooking will effectively kill all encysted and adult parasites, the chances of contracting any of the entozoa from fish are too remote to be considered. A badly infected fish showing numerous cysts, a mass of wiggling nematodes in the muscle tissue, or worms in the body cavity released by the chance cutting of the intestine may offend the aesthetic sense but these cysts and worms could be swallowed without cooking with no ill effects whatever.



A Nematode. Monhysteria sentiens
Side view of female. x125 (after Cobb)



B Acanthocephalus ranae. Entire male
x30 (After Van Cleave.)

FIG. 1.

REFERENCES

Cobbold, T. S. 1883. The destruction of fish and other aquatic animals by internal parasites. Int. Fish. Exhib., Vol. VI, pt. III, pp. 1–20. London. 1883.

Linton, Edwin. 1893. Some observations concerning fish parasites. Bull. U. S. B. F. 1893. (1894.) Vol. XIII, pp. 101–112.

1897. An economical consideration of fish parasites. Bull. U. S. B. F. 1897. (1898.) Vol. XVII, pp. 193–199.

1908. Notes on the flesh parasites of marine food fishes. Bull U. S. B. F. 1908. (1910.) Vol. XXVIII, pp. 1195–1209.

1912. Cestode cysts in the flesh of marine fish and their bearing on food values. Trans. Amer. Fish. Soc. 1912. Pp. 119–127.

Ward, H. B. 1912. The distribution and frequence of animal parasites and parasitic diseases in North American fresh water fish. Trans. Amer. Fish. Soc. 1912. Pp. 207–241.

1918. Parasitic Flatworms. Freshwater Biology. Ward, H. B., and Whipple, G. C. (John Wiley and Sons, Inc., New York. 1918.) Pp. 365–453, fig. 651–764.

Parasitic Roundworms. Pp. 506–552, fig. 811–855.

THE MANAGEMENT OF DUCK MARSHES

By Leo K. Wilson

THE LAST DAY of October marks the exodus of thousands of sportsmen from the cities of California, all of them headed for the duck marshes, for November 1st is the opening day of the waterfowl season and from that day until the end of December, duck shooting occupies the attention of a major part of the sporting population of the State.

Not more than twenty years after California was admitted into the Union the first private duck clubs were organized in this State. Since that time, many of these clubs have been maintained with only a slight change in personnel. Either the founders, or their direct descendants, are shooting over the same ponds that provided sport in the Seventies and Eighties. In spite of the inroads of civilization, the inland duck marshes have been maintained to a large degree by the activities of the private shooting clubs. It is only natural then that many refinements in the management of duck marshes have been worked out in this State. Many of them should be of interest to sportsmen who enjoy wild-fowling.

Much of the success attained by shooters on any marsh is directly attributable to good husbandry in the matter of preparing the land and maintaining it through the shooting season. Returns from money invested on duck club properties is in direct proportion to the amount of care and attention that is given in keeping up the ponds. The greatest developments in this regard have been reached in the fresh-water marshes. In the salt water areas and on the salt water bays where diving ducks are the chief bag, the systems utilized are much the same as in other states, but California sportsmen have worked out some novel devices, in the management of grounds devoted to the shooting of puddle ducks.

The pintail, so general in their distribution and better known on the California marshes as sprig, provides the majority of the inland shooting in California. Old timers generally admit that the proportion of pintail to other ducks has increased materially during the past 30 or 40 years. Widgeon, green-winged teal, mallard, shovellers or spoonbills and cinnamon teal also appear in numbers, but the sprig represents the leading species on the game straps of most shooters. Two theories are advanced for the preponderance of these birds. The first is that the provision by shooters of freshwater ponds has attracted these birds and caused them to remain over in California on their southern migration. The other theory, and one that is probably more tenable, is that most of the duck marshes at the present time have been artificially created and the ponds are shallow, more to the liking of these birds than to the other species. In fact pintail will work to areas recently flooded where there are no fringes of tules which are not at all attractive to mallard and very little more so to teal and other species.

In these shallow, artificially constructed ponds, most of the shooting is done from sunken blinds. These blinds are largely of one type of construction—a barrel constructed either of redwood or metal is embedded in the bottom of the pond until it is almost flush with the surface of the water. The redwood barrels are more expensive but they are also more comfortable for the shooter and can be made larger than the easily procured metal drum. They are more expensive and for that reason are normally utilized only where more care is given to the upkeep of the grounds. The metal tanks are usually constructed by the process of cutting the top from large oil drums with an acetylene torch. The jagged edge is then smoothed over and the blind is ready to be placed in the pond.

In the days when duck marshes were of greater extent and the flight varied with the abundance of the food supply, it was desirable to have a blind that could be readily moved. For this purpose a cylinder of metal some five feet long and 3¾ to 4 feet in diameter about the top of which a rim of one-inch iron pipe was fastened, both ends left open, was used. The shooter would select the spot where this blind would be the most desirable and the hollow cylinder would be driven into the mud, the sharp cutting edge down. After being embedded in the adobe, the water and mud would be removed from the inside and a very serviceable, though sloppy, blind would be formed. Because of the character of the soil, very little water seeped in from below. This is the type of blind commonly used by the market hunter.

Where the shooting is done over deep water ponds and in very porous soil where it would be impossible to sink the ordinary type of barrel or blind, platform blinds are constructed. These are mere platforms usually from three to five feet square set up on piles flush with the surface of the water. A net of poultry fencing 2¼ to 3 feet high is placed around the sides, into which is woven a dressing of tules or other native sedges. Means of ingress and egress are provided by a moveable door on a break in this side trimming. Where growth of rushes or tules are available, these platform blinds are frequently located in such positions that no dressing is needed, and with

Fig. 5. A platform blind frequently used on deep water ponds.

only a rail on one side to support the gun and to prevent the shooter from stepping off into deep water.

Very little shooting is done from sneak boats on many of the duck marshes at the present time. Sculling has become a lost art with most hunters. However, one or two old-timers still prefer to shoot from a sneak boat. When boats are used, two types of dressing are usually provided—the first is constructed by covering the deck of the boat with a piece of poultry fencing or old fish net in which rushes, tules or the stems of various water grasses are woven to simulate a natural growth and an even more satisfactory method is to plaster the

deck of the boat and the visible sides with a heavy coating of the adobe mud from the bottom of the pond. This system is frequently used by the scull-boat men in their activities on the open waters of inland lakes and waterways.

Great care is taken on some marshes where sunken barrels are used for blinds to encourage the growth of natural rushes and tules about the sides of the blind. In places where there is no natural growth, various water grasses are broadcast on the surface of the water and naturally grow rankest in those exposed positions of land surrounding the barrels. The desire for a natural growth of tules on duck marshes has lead to one abuse. On many shooting properties, dogs are not allowed to be taken into the blinds by the members for the reason that they smash down the tules in getting in and out of the blinds. The retrieving of crippled birds is therefore left to the keepers who work the dogs after the shooting is over.

Great differences of opinion exist as to the effect of board walks upon the ducks in a particular marsh. Some of the most successful shooting properties in California are those upon which board walks, constructed of 2x12 planking extend from the boat landings or club houses right up to the blinds. Where water is of an uneven depth, or where the bottoms of the ponds are soft, these walks provide great comfort to the shooters in getting to and from the blinds. Birds working to decoys or in their natural flyways show little or no fear of these artificial niceties. The use of the board walk is becoming more and more general.

Many clubs are so situated that the ponds from which the shooting is done lie at some distances from the club houses. In those cases, where it is possible, a horse-drawn vehicle is used to get the shooters to and from the decoys. In many places, however, it is impossible to use anything more than a boat to reach the shooting locations. Boats of various types are utilized—usually a row boat with an outboard motor. Boat landings are provided along the water course, which are marked with a white stake or some object readily visible in the half light of early morning. From this place to the blind, a wire of noncorrosive material is stretched; the shooter is let off the boat at the landing and walks directly to the white stake; then he hooks his game strap about the wire and walks with ease to his blind. In areas where blinds are constructed flush with the surface of the water and where a slight deviation from the course might result in the shooter going over his head in deep water, this wire is of great assistance.

Many types of seats for use in the duck blinds are provided by the sporting goods market. However, these are refinements which many clubs have not yet afforded their members. The ammunition case, or a stool similar to the old milking stool, is the customary seat. Since the piano bench has replaced the old-fashioned whirling piano stool, the latter may be picked up for very little money in second-hand stores. Some properties have equipped each blind with seats made by cutting the legs from these stools until they are of the height desirable for use in the blinds and they make a most satisfactory arrangement.

One of the most useful items in the sunken blinds is a hook upon which to hang excess clothing, the shell bag and other accoutrement to

keep it from being deposited in the damp bottom of the barrel. "S" hooks made of ¼-inch wire, one end of which hooks over one side of the barrel and the other hook being available for suspension purposes are very satisfactory additions to any blind. More elaborate shelves constructed to hang from two hooks on the inside of the barrel upon which may be placed lunch, ammunition and other objects are frequently utilized.

Another refinement which is of particular importance where fine guns are used in metal barrels is a bumper prepared by placing a short section of garden hose over a piece of heavy wire which is hooked to the sides of the barrel. The gun is set against this hose which acts as a buffer instead of allowing it to be damaged by the rough edges of the metal drum.

Early in the season, before the birds in any marsh have been much shot at, a great deal of care is not needed in the constructon of the blinds. Later though, when the ducks begin to be "blind shy" the greatest degree of care is necessary. For that purpose, covers are frequently made for the sunken barrels. A hook of ½-inch iron wire is made slightly larger than the top of the barrel. This is covered with poultry fencing, or a section of fish net, into which grasses and tules are woven. Anyone who has viewed these black craters representing duck blinds from an airplane can appreciate the added camouflage that these covers provide.

The excessive cold is not usually experienced in the duck marshes of California. However, there are days when the thermometer drops to very low levels and at such times any heating arrangement is of value. One of the most satisfactory arrangements to provide warmth in duck blinds is then provided by the use of canned heat. Without any added equipment, the heat provided by the ignition of a can of this material is considerable. However, if a section of small stove-pipe, slightly larger than the can to be used, is strapped to the inside of the barrel in such a manner that it can be lifted from the floor of the blind far enough to allow the insertion of a can of the lighted material at the bottom and then allowed to drop into place, a very serviceable stove is created. The use of the chimney in this fashion allows a draft and against the warm sides of the pipe, the hunter may warm his hands.

Of even greater importance for the comfort of the shooter than the matter of heat is protection against mosquitoes, which are to be found on the average marsh during the early days of the season. With the shooting season opening in October there is usually a matter of six weeks before any frost occurs which will kill off the mosquitoes. Many clubs provide their shooters with spray equipment, the cans being filled with one of the many commercial insecticides now upon the market for use in such apparatus. This is an investment well worth while where mosquitoes are abundant.

Most hunters are well able to keep track of the number of ducks that they have dropped during the morning's shoot, but the requirement that members stay within the limit regulations is a very strict one on most properties. For that reason, the small mechanical calculating machines manufactured for golfers are often provided in the blinds.

As each duck is killed, it is tallied on the indicator and all shooting stops when fifteen birds are down.

Too much can not be said for the conservation work that has been carried on by the private duck clubs in California. At the present time there is approximately 10 per cent of the freshwater marsh area in California that existed ten years ago. Practically all of this is controlled by private shooting clubs. While the members of these clubs take a reasonable toll from the bird population of those marshes, it should be remembered that shooting is allowed on most clubs but two days a week and then for a matter of four hours in the morning only. So while the duck preserves are shooting preserves for eight hours each week, they are waterfowl refuges for the other 160 hours.

THE QUAIL REPLENISHMENT PROGRAM

By Gordon H. True, Jr.

(With two photographs by author)

THOSE of the present generation of sportsmen who, with dog and gun, have been wont to tramp the chaparral covered foothills of California in pursuit of the valley quail have witnessed a gradual but sure depletion in the ranks of that peer of upland game birds. Pitted against man the conqueror and harassed by natural enemies, the fight has been a losing one. Without help, he will soon be gone. Let us hope that those who have watched him go will hear again the whir of wings and the clear, merry call of the plumed knight of the chaparral from the brush-covered hillsides where his kind once flourished.

The California valley quail, though few in numbers in many places where they were once numberless, are far from being an extinct species, but unless something is done the quail hunter will soon be forced to place his shotgun in the rack and leave it there. With the idea in mind of preventing such an eventuality, the Division of Fish and Game is, at the present time, engaged in a quail replenishment program which, it is felt certain, will result in returning birds to cover that is now barren and increasing the numbers of birds in areas where they are still present. The project, in brief, involves the establishment of groups of inviolate quail sanctuaries wherein the birds may reproduce unmolested by man and, in so far as such a thing is possible, by natural enemies. This work is now under way in the southern part of the State. It is not intended, however, that this program, state-wide in scope, be limited to any one region, but will eventually embrace the State as a whole.

Four factors are of primary importance in the selection of a quail refuge site; namely, food, cover, water and the proximity of land on which the public is permitted to shoot. The first two factors have presented no serious difficulties. There are vast areas in southern California which not only provide ample cover, but an abundant food supply as well. In all instances the presence or absence of an

adequate water supply is the deciding factor. Where, in the past, there have been natural water supplies sufficient to take care of the needs of large coveys of quail, the water has largely been taken for domestic and agricultural purposes. This drying up of large areas by man has been a potent factor in the reduction of quail populations. Where water is present, the drinking places are often so few and far between as to result in undue concentrations of birds in limited areas. The well-known fact that unscrupulous hunters have taken advantage of such situations by killing birds at the water holes has worked toward the decimation of the species.

Fortunately, a scheme has been evolved whereby natural water supplies may be supplemented artificially. The set-up, originally worked out by Mr. James Moffitt but later somewhat modified, consists of a fifty-five gallon galvanized drum to which is attached an automatically fed drinking trough. The arrangement has proven to be entirely satisfactory and units are being installed at the present time on those sanctuaries which are not already sufficiently provided with water.

FIG. 6. Water barrel with drinking trough for birds in foreground perfected to supply water in arid sections. December 4, 1932.

In regard for the fourth requisite, that of the proximity of lands open to shooting, it should be made clear that it is the desire of the division that the overflow of birds from the closed areas be made available to the sportsman at large and not to a favored few. Hence, the sanctuaries are being so situated that this may be the case.

When, with an eye to the foregoing factors, a satisfactory refuge site has been selected, it is then necessary to secure the property under such conditions that the work may proceed without interruption. An agreement is drawn up between the division and the property owner which allows the former to carry on those activities necessary to the proper establishment and maintenance of a quail refuge; that is, to post and patrol the property, establish watering places, erect necessary fences and buildings, practice predatory animal control and, in general, to improve habitat conditions. The owner, in turn, agrees to permit no

shooting on the property. An agreement, thus executed, remains in force for a period of three years and thereafter until terminated by either party. It has not always been possible to secure property under such an agreement. Fortunately, however, the majority of landowners who have been approached have expressed their whole-hearted approval and have gladly permitted the use of their lands in this quail replenishment program.

Property, once acquired, is immediately posted with notices informing the public that the area is closed to hunting and warning trespassers of prosecution under the provisions of section 627 of the Penal Code. It has been the policy to place these warning signs not only on the exterior boundaries of a closed area, but along both sides of all roads and trails that cross it as well. In both places they are placed at intervals so frequent as to make it impossible to enter a refuge without having been apprised of the fact that it exists. When property is unfenced, posts are set and signs are placed thereon at such a height as to make them clearly visible.

It has already been stated that the refuges are being established in groups. In immediate charge of each group is a trapper and game

FIG. 7. Corner post of an unfenced refuge in Antelope Valley. December 4, 1932.

refuge caretaker who is responsible for the welfare of the sanctuaries of which it is composed. This man will not only carry on a campaign against the bird and mammal enemies of his feathered charges, but will also maintain the watering places, patrol the various refuges and, in general, do everything possible to improve habitat conditions. His is an important work and it is felt that the employment of these gamekeepers will go far toward making the project a successful one. It is certainly a long step in the right direction and it is certain that this refuge system will be more productive of results when under the constant surveillance of trained men than would be the case if the property were merely posted, leaving the rest of the problem to Dame Nature for solution.

To supplement the natural supply of birds on the refuges, game-farm reared birds have been released from time to time during the past few months. The facilities of the Los Serranos game farm, at Chino, are now being devoted almost entirely to the production of valley quail. This year, the first during which quantity production of quail has been attempted, nearly four thousand birds were reared. Next year a far greater number will be available for distribution. The birds are transported from the game farm in specially constructed crates and are liberated at various points on the refuges, always at water. From one hundred to two hundred birds have been allotted to each sanctuary. All the birds are banded with state bands prior to liberation and sportsmen have been urgently requested to return all bands recovered by them to the Division of Fish and Game. A great deal of valuable information may be obtained through the medium of bird banding but to what extent, in this case, is dependent largely upon the cooperation of the quail hunter.

To date, twelve refuges constituting the San Bernardino-Riverside group have been established in those counties. They comprise, in all, 13,853 acres. Ten of these refuges are being devoted to the production of valley quail while two, situated in the Mojave Desert, have been selected as propagating areas for a near relative, the Gambel quail or "redhead." Since July 23, 1932, 1725 birds have been liberated on these sanctuaries, 152 being Gambel quail. At the present time another refuge group is being established in the Antelope Valley region of Los Angeles and Kern counties and it will also include sanctuaries in Mint, Bouquet, Soledad and other canyons lying between the Antelope and San Fernando Valleys. A supply of birds is being held for release in this region at the close of the present quail season. Six thousand five hundred acres have already been made a part of this Antelope Valley group.

In connection with the formation of refuges and the work of field quail propagation, it is hoped that certain areas adjacent to the closed areas may be obtained as public shooting grounds. That is, areas that shall be closed to shooting of any sort except during the open quail season. The establishment of such areas would be of vast benefit to the quail hunter who, at the present time, often finds it difficult to locate an area where he may be permitted to indulge in his favorite pastime. One such public shooting ground is now in process of formation in San Bernardino County.

In conclusion, let it be said that if this project is to be a success, the aid of each and every sportsman must be enlisted. The quail sanctuaries must remain inviolate. It is hoped that no devotee of upland game bird shooting will, through any act of his, do anything to hinder this work, the ultimate result of which will benefit no one so much as himself. Give the birds a chance.

NEW METHOD DEVELOPED FOR THALLIUM DETERMINATION

By Paul A. Shaw

DURING the progress of the thallium studies recently reported,[1] the need of a rapid and more accurate method for the quantitative determination of thallium in the tissues of poisoned animals became evident. Studies were therefore conducted with the result that a satisfactory colorimetric method has been developed, the details of which will be published in the Analytical Edition of Industrial and Engineering Chemistry.

Following the destruction of the animal tissues by a standard procedure with hydrochloric acid and potassium chlorate, an unique feature of the analysis consists in the extraction of thallium with ether. After additional purification of the ether residue the thallium is oxidized with bromine, and a quantity of iodine equivalent to the thallium is liberated by the addition of potassium iodide. The liberated iodine is extracted with carbon bisulfide in which solvent the color intensity is proportional to the iodine concentration. A wedge type colorimeter with a suitable standard is utilized for accurate measurement of the color intensity and from this value the amount of thallium is computed.

Thallium poisoned tissues will usually contain from 1/1000 to 5/1000 of one per cent thallium. It is therefore evident that the analyst must be able to measure very minute quantities of this element. The method developed is capable of measuring within 3 to 5 per cent of the correct quantity of thallium in samples of tissue weighing only 10 to 20 grams, and the entire analysis may be completed within three hours. Former methods on material of this type required samples five times as large, the analysis could not be completed in less than a day and a half, and the final result might be in error by 10 per cent or more.

The method developed has been used to study in more detail the distribution of thallium in various body tissues and also the rate of excretion. This work confirms that previously published in regard to the high concentration in muscular tissue and indicates that complete elimination from a sub-lethal dose requires several months. Of tissues studied, fat was the only one found that absorbed only traces of the ingested thallium. Thigh bone and muscle appeared to retain a high concentration for a longer period, and are therefore best adapted for tests in cases of suspected thallium poisoning.

[1] Shaw, Paul A. Studies on thallium poisoning in game birds. CALIFORNIA FISH AND GAME, Vol. 18, No. 1, January, 1932.

ROCK BASS (PARALABRAX) IN THE CALIFORNIA COMMERCIAL FISHERY*

By Frances N. Clark

INTRODUCTION

DURING the past year or two sport fishermen of California have considered the advisability of prohibiting the taking of rock basses by commercial fishermen. To determine, if possible, the need for such a measure, to formulate the best type of law if legislation was found necessary, and to ascertain the effects of such a law if enacted, a brief study of the commercial rock bass fishery was made by the writer during 1932. Information on fishing gear, seasons and locality was obtained from the statistical records of the Bureau of Commercial Fisheries of the Division of Fish and Game of California. The life history notes were secured from observations in the San Pedro wholesale fish markets made chiefly by the writer and suplemented by Mr. Richard S. Croker, whose assistance is gratefully acknowledged.

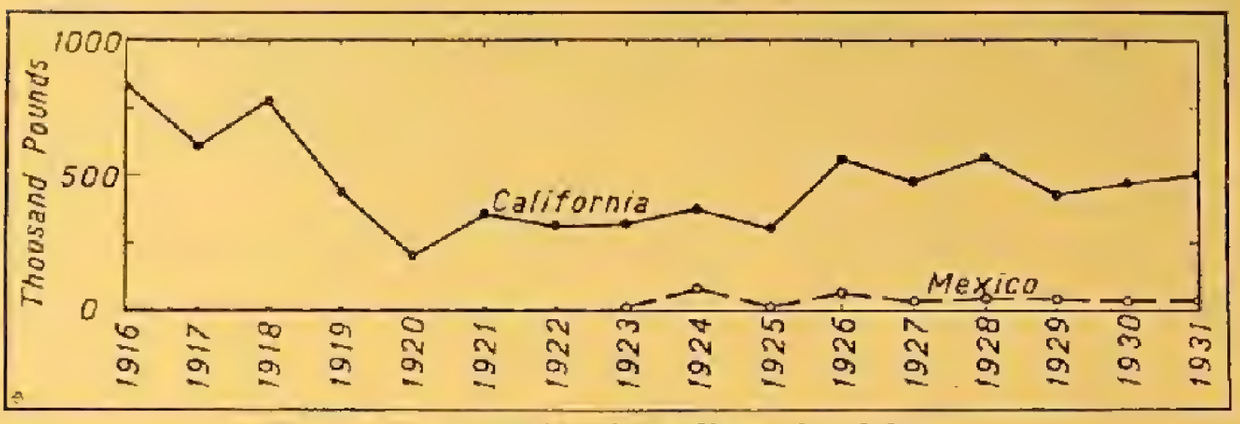


Fig 8. Yearly California landings of rock bass.

All the species of *Paralabrax* occurring in California waters are listed in our records as rock bass. These fishes play a very minor role in the commercial fisheries of the State. If mollusks, crustaceans and cannery fish are disregarded, rock bass have ranked from fifteenth to twentieth in importance during the past ten years, but if all fishes are considered they drop to about thirtieth in position. For the past sixteen years, 1916–1931, the yearly catch has fluctuated around 500,000 pounds. A small amount is imported from Mexico but this poundage has never reached 100,000 in any year. The total year by year catch is shown in figure 8.

* Contribution No. 129 from the California State Fisheries Laboratory. September, 1932.

FISHING REGIONS

Rock bass are found from San Francisco southward into Mexican waters but are not taken commercially in appreciable numbers north of Point Conception. For statistical purposes the fishing area south of this point has been divided into four regions: Santa Barbara, including landings in San Luis Obispo, Santa Barbara and Ventura counties; San Pedro, including the catch of Los Angeles and Orange counties; San Diego, comprising the catch of San Diego County; and Mexico, covering all fish taken south of the international boundary and landed at California ports. Figure 9, which shows the average

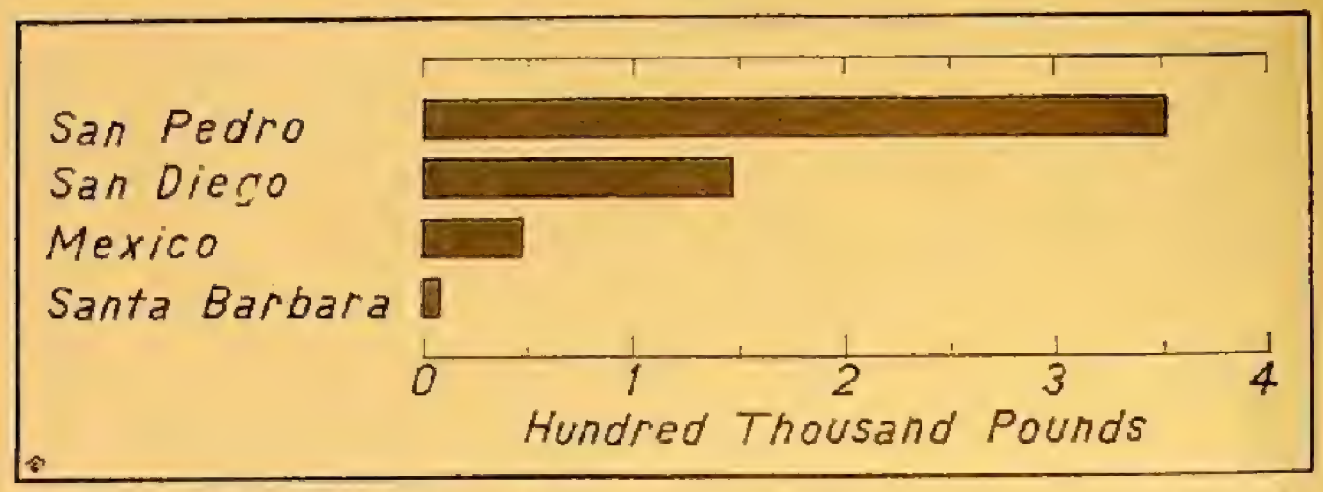


FIG. 9. Average yearly landings of rock bass for five years, 1926–1930, grouped by regions.

yearly catch by regions for five years, 1926–1930, indicates that the San Pedro region is by far the most important in the rock bass fishery. San Diego receives less than one-half as much as San Pedro, the Mexican catch is about one-seventh, and Santa Barbara landings are almost negligible.

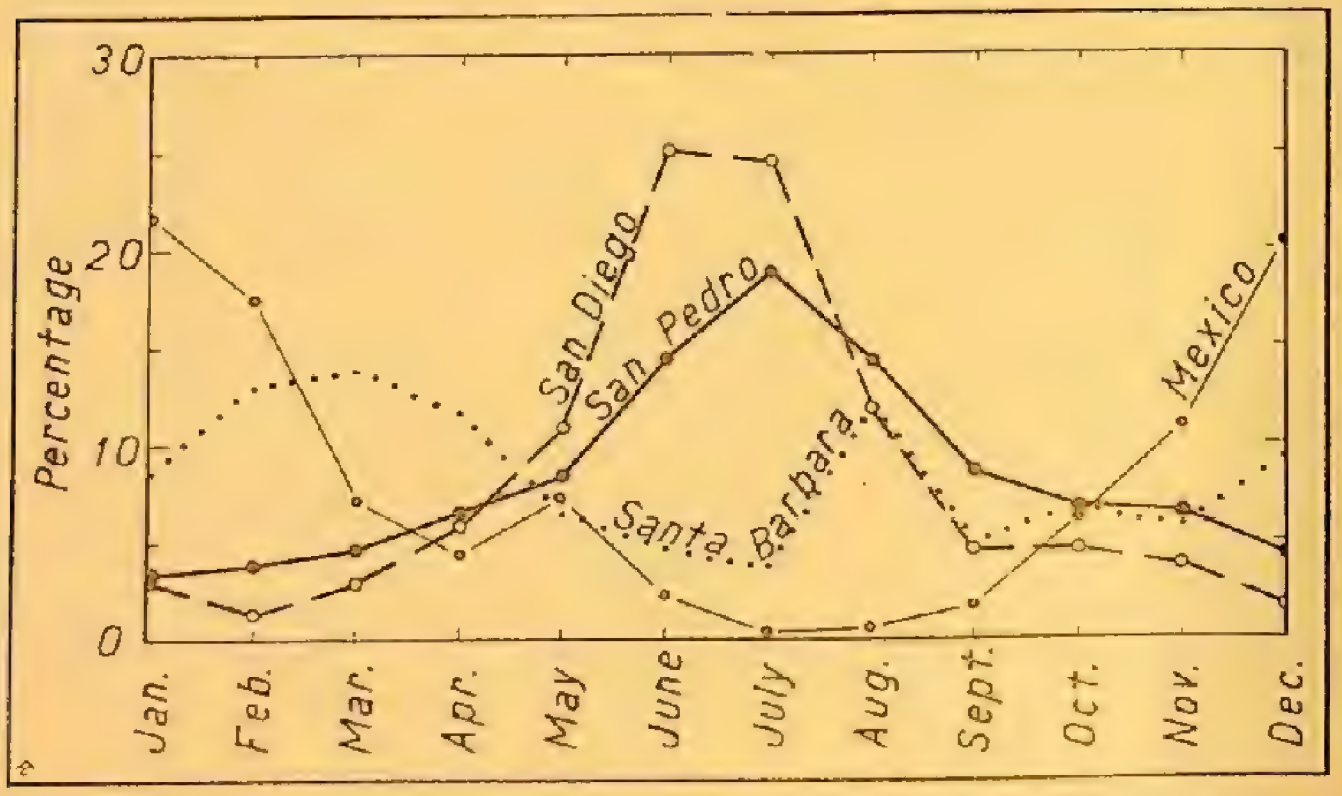


FIG. 10. Average monthly catch of rock bass for each region, based on the five-year interval 1926–1930.

FISHING SEASONS

To determine whether or not the fishery in each of these regions is seasonal in occurrence, the monthly landings for the five-year period, 1926–1930, were averaged by regions and these averages expressed in percentages of the totals. The results are shown in figure 10. In the San Pedro and San Diego fisheries the major part of the catch occurred in the summer months—from May to August. Off Santa Barbara the heaviest fishing was carried on in February, March and April, with a second peak in August. Rock bass brought in from Mexico were taken during the winter months from November to February. Since 90 per cent of the rock bass is landed in the San Pedro and San Diego districts we may conclude that the commercial rock bass fishery of California is a summer fishery.

FISHING GEAR

Rock bass are caught with every conceivable type of commercial fishing gear. Hand and set lines, entangling nets such as gill and trammel nets, encircling nets as lamparas and purse seines, traps, and trawls all contribute to the California rock bass fishery. Because of the variety of gear which takes rock bass, the number of boats featuring in the rock bass fishery is large, but the catches made by the individual boats are small.

TABLE 1

Number of boats fishing for rock bass classified by region and by average number of pounds delivered per month, based on data from July, 1931 to June, 1932.

	Santa Barbara		*San Pedro*		*San Diego*		*Totals*	
Pounds per month	*No. of boats*	*Per cent*	*No. of boats*	*Per cent*	*No. of boats*	*Per cent*	*No. of boats*	*Per cent*
1–99	12	100	235	84.6	67	69.1	314	81.2
100–199			19	6.8	9	9.3	28	7.2
200–299			10	3.6	5	5.1	15	3.9
300–399			4	1.4	5	5.1	9	2.3
400–499			1	.4	2	2.1	3	.8
500+			9	3.2	9	9.3	18	4.6
Totals	12	100	278	100.0	97	100.0	387	100.0

Table 1 shows the number of boats fishing for rock bass, classified by region and by the average number of pounds delivered per month. This table was compiled from data covering the period from July, 1931, to June, 1932. For all regions, a total of 387 boats made deliveries in this twelve-month interval, but 314, or 81 per cent, averaged less than 100 pounds per month. All but 18 averaged less than 500 pounds per month. In this study we have considered rock bass fishing as incidental for all boats that average less than 500 pounds per month. On this basis 95 per cent of the boats taking rock bass in California catch these fish with gear primarily planned and fished for other species. But since the 18 boats delivering more than 500 pounds per month caught 47.4 per cent of the total poundage, only about half of the total catch may be termed the result of an incidental fishery.

To determine the type of gear making the heaviest catch of bass, the poundage of the 387 boats delivering rock bass was classified according to the apparatus used. For this classification the gear was grouped as follows: hand and set lines; gill and trammel nets;

encircling nets, including lamparas, ring nets and purse seines; traps; trawls; and pleasure boats using hook and line. The inclusion of pleasure boats in the commercial fishery is explained by the fact that in the San Pedro region a number of boats which take out parties for pleasure fishing sell the surplus catch to the commercial markets. In some instances the boat owner has a commercial license and sells all fish the pleasure fishermen do not care to take home. In other instances individuals purchase commercial fishing licenses, fish from the pleasure boats and sell their own catches. In both cases our statistical records credit the catches to the boats on which they were made and not to the individuals taking the fish. Table 2 gives the commercial poundage according to gear.

TABLE 2

Rock bass catch classified by gear and region. Data collected from July, 1931 to June, 1932

	Santa Barbara		*San Pedro*		*San Diego*		*Totals*	
Gear	*Lbs.*	*Per cent*	*Lbs.*	*Per cent*	*Lbs.*	*Per cent*	*Lbs.*	*Per cent*
Hand and set lines	2,890	62.2	144,510	62.9	90,510	48.7	237,910	56.6
Gill and trammel nets	580	12.5	19,100	8.3	9,950	5.4	29,630	7.0
Encircling nets			13,070	5.7	3,240	1.7	16,310	3.9
Pleasure boats			51,320	22.3			51,320	12.2
Traps	430	9.2	1,770	.8	82,160	44.2	84,360	20.1
Trawls	750	16.1					750	.2
Totals	4,650	100.0	229,770	100.0	185,860	100.0	420,280	100.0

In every locality, as shown in table 2, the greatest poundage was taken by hand and set lines and comprised 57 per cent of the entire catch. The next highest poundage was taken by traps. This is particularly true of the San Diego region. In former years, rock bass traps were used to a large extent for catching bass both in the San Pedro and San Diego regions. This gear has now been outlawed except when used as spiny lobster traps. The heavy poundage now taken in traps at San Diego is caught during the lobster season.

Pleasure boats ranked third, contributing 12 per cent to the rock bass landed, but as far as our records show these boats sell their bass commercially only in the San Pedro region. The poundage recorded from these boats comprises only the commercial sales and not the fish caught by pleasure parties and not sold. Encircling and entangling nets contributed the final 10 or 11 per cent to the rock bass catch.

According to table 1, rock bass fishing is more than incidental for 18 boats in the San Pedro and San Diego regions. Our records indicate that of these 18 boats, 8 used hand and set lines, 6 chiefly traps, 1 gill or trammel nets, 1 a ring net, and 2 were pleasure boats. Thus, as with all the boats delivering rock bass many kinds of gear were employed, but the hand and set lines occupied the major position.

CHANGES IN THE AVAILABLE SUPPLY

An accurate measure of the available supply of rock bass is not obtainable from the commercial catch. Because the majority of fishing boats take rock bass only incidentally the commercial catch offers no continuous effort, sustained over a period of years, on which a study of changes in rock bass supply can be based. If we had records of the sport catch we could arrive at a much more accurate estimate of the

yearly abundance of rock bass, but since such records are not now at hand a rough estimate of abundance has been attempted from the commercial catch data.

For this measure the catches of the eighteen boats in the San Pedro and San Diego regions that averaged more than 500 pounds per month were examined. Because these boats did not fish with equal intensity each year or for a long period of years the study could not antedate 1924. The catches of the San Diego boats taking rock bass in traps during the lobster season had to be omitted because the same boats did not operate for any extended period of years. The data for the two pleasure boats in the San Pedro region were also omitted for the size of their commercial catch was presumably largely determined by the number of fish not wanted by the sportsmen and therefore sold. The large size but infrequent nature of the ring net catches also necessitated the elimination of those data. This study is based therefore on the 9 remaining boats. The catches of these boats were grouped as follows: San Diego hand and set lines, San Pedro hand and set lines, and San Pedro gill and trammel nets. To give each type of gear the same influence in the final analysis the yearly average catch per trip was calculated for each group separately and these averages given equal weight in determining the final yearly average catch per trip.

For all types of gear except gill and trammel nets the largest catches were made during the summer months. For the gill and trammel nets the heaviest catches were made during the late summer, fall and early winter months. If in some years the majority of the catches were made in months when fishing returns per trip are low, these years would have a lower yearly average catch per trip than years when the catches were chiefly made when returns per trip are high. Because of this disturbing factor, which enters into most studies of the returns per unit of effort, two types of averages were calculated for this rock bass study: (1) averages based on the entire year's catch, and (2) averages based on selected months when largest catches are made. The results are shown in figure 11.

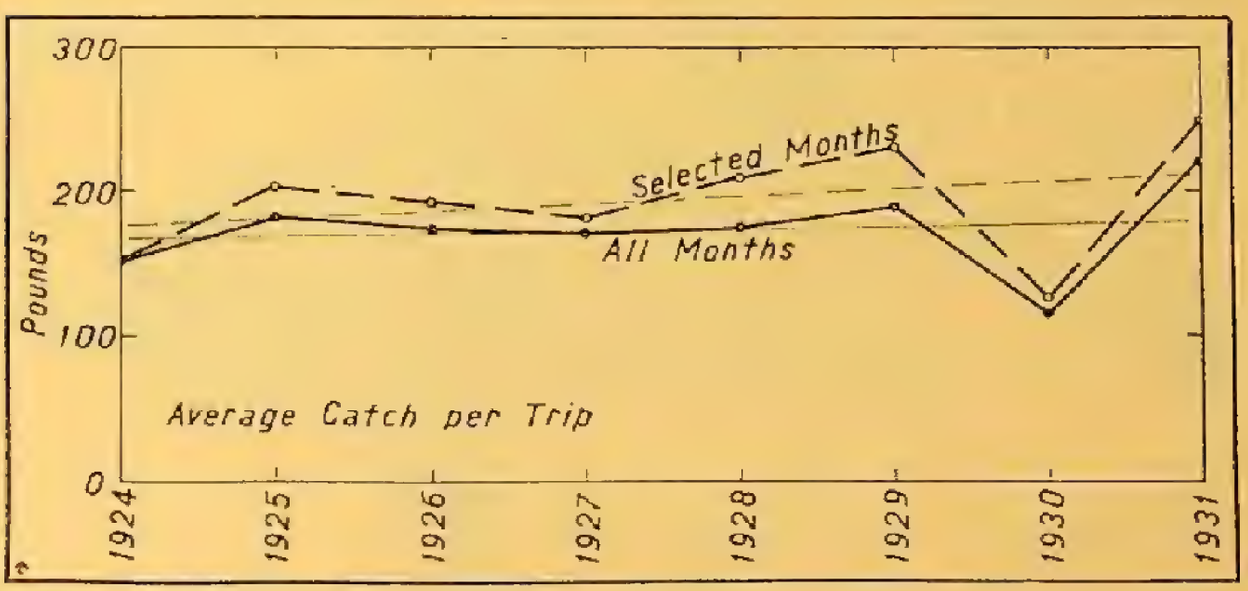


FIG. 11. Yearly average catch per trip of selected commercial fishing boats taking rock bass in the San Pedro and San Diego fishing regions

As is to be expected the average catch per trip was slightly greater when based on selected months than when based on the entire year's data. For both types of averages the catch per trip varied from year to year but showed no definite and continuous upward or downward trend. Straight lines fitted to the curves by the method of averages have a slight upward slope but the slope is too slight to be considered indicative of any increase in available supply. Neither is there any suggestion of a continued decrease in supply. This study, although falling far short of an accurate measure of abundance, gives the truest estimate obtainable at present and does not indicate that the supply of rock bass available to the fishermen has undergone any significant changes from 1924 to 1931.

SPECIES INVOLVED

Three different species of *Paralabrax* occur in California waters: *P. nebulifer,* known officially as rock bass; *P. clathratus,* officially termed kelp bass; and *P. maculatofasciatus,* or spotted rock bass. Figures 12, 13 and 14 illustrate these three species and show the distinguishing characters of each. The kelp bass may be separated from the rock and spotted rock bass by the shape of the dorsal fin. The third spine of the kelp bass fin is scarcely longer than the fourth while the third spine of the other two species is considerably longer than the fourth. As shown in the photographs, the difference in the length of the spines produces a difference in the contour of the erect dorsal fins and affords a ready means of separating the kelp bass from the two species of rock bass. The spotted rock bass may be distinguished in its turn by the fact that it is everywhere covered with spots. The young of the rock bass have spots on the cheeks but at no time are they completely spotted as are the spotted rock bass.

The spotted rock bass inhabits more southerly waters than the other two species. While it is taken in small quantities by sport fishermen in the bays and lagoons of the San Diego region, it rarely enters into the commercial catch with the possible exception of a small proportion landed from Mexican waters. Since the entire Mexican catch constitutes less than 10 per cent of the total catch, the spotted kelp bass may be disregarded in a discussion of the species involved in the commercial bass catch.

TABLE 3

Percentage of rock and kelp bass observed in the San Pedro fresh fish markets during 1932

Month	*No. of lbs. observed*	*Percentage*	
		Rock bass	*Kelp bass*
January	115	98.1	1.9
February	100	85.0	15.0
March			
April	105		100.0
May	950	4.7	95.3
June	960	42.2	57.8
July	1,525	35.2	64.8
August	4,945	6.9	93.1
September	1,330	2.8	97.2
October	2,310	1.7	98.3
November	2,410	7.7	92.3
December	130	80.4	19.6
Year	14,880	12.7	87.3

FIG. 12. Kelp bass, *Paralabrax clathratus*.

FIG. 13. Rock bass, *Paralabrax nebulifer*.

FIG. 14. Spotted rock bass, *Paralabrax maculatofasciatus*.

To determine the proportion of rock and kelp bass entering into the California commercial catch, observations were made in the San Pedro wholesale markets. During 1932 the markets were visited two or three times a week and at times oftener. If any bass were found, the percentage of each species was determined by counting a number of each until a representative sample had been examined. These percentages were then weighted by the number of pounds comprising the entire lot. The data were further combined by months and the results shown in figure 15 and table 3. These data indicate that kelp bass are

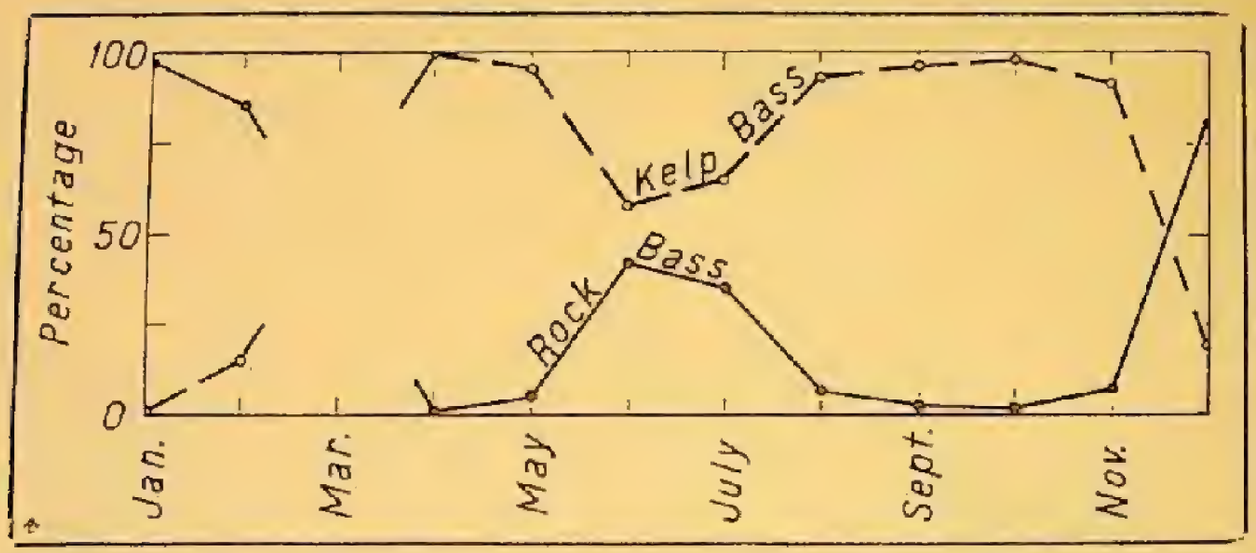


FIG. 15. Monthly percentages of rock and kelp bass in the San Pedro wholesale fish markets.

the main support of the fishery. In December, January and February more rock than kelp bass were noted, but the observations for these months are too few to justify the conclusion that the rock bass fishery will always exceed the kelp bass during the winter months. The proportion for the entire year was 12.7 per cent rock bass and 87.3 per cent kelp bass. We do not have observations on the San Diego catch but the proportion of the two species presumably does not differ greatly from San Pedro.

LIFE HISTORY NOTES

Information on the time of the spawning season and the size at first maturity was also obtained at the San Pedro wholesale markets. Unfortunately most of the rock and kelp bass are cleaned on the boats before they are delivered to the markets. For this reason our information on spawning and maturity is all too scanty, but throughout the summer of 1932 sufficient fish were examined to determine the spawning season and to give an approximate idea of the size at first spawning.

On May 12, fish of both species were examined and showed little evidence of the onset of spawning. On May 26, all the larger kelp bass were maturing but the smaller ones were not. Practically no rock bass were seen on this date. On June 2 and 9, both rock and kelp bass were found in a ripe condition. The next round fish were observed on July 8 when both species appeared to be in a practically mature condition. Again on July 14, rock and kelp bass were found completely mature and ready to spawn. The next observation, made

on August 8, showed that both species were still spawning. A few fish examined on September 2 appeared to be spent. From these scattered observations we would conclude that both rock and kelp bass spawn during the summer months of June, July and August.

Throughout these three months, 80 rock bass and 75 kelp bass were measured to determine the size at first maturity. Measurements were made with a steel tape from the tip of the lower jaw over the body to the middle of the tail. Since the tail is scarcely cleft this practically constitutes the total length. Measurements were read to the nearest half centimeter but later grouped by centimeters.

Of the 80 rock bass measured only 2 fish were smaller than 27 cm., or about 10 inches. One of these, 23 cm. in length, was immature and the second, 25 cm., was maturing. Apparently the small immature rock bass are not taken by the commercial fishermen. Since many small rock bass are caught by sport fishermen in the shallow bays and lagoons of southern California it seems probable that these young fish do not frequent the areas in the open ocean where commercial fishermen operate.

Kelp bass as small as 20 cm., 8 inches, were measured from the commercial catch. All fish smaller than 24 cm. were immature as were about half of those between 24 and 26 cm. All larger than 26 cm. were maturing. Presumably the average size at first maturity for kelp bass is about 25 cm., or 10 inches. The scanty evidence available also indicates approximately the same size for first maturity of the rock bass.

The length frequency curves of figure 16 based on the above mentioned measurements give a fair idea of the sizes of rock and kelp bass comprised in the commercial catch. For both species the majority of the fish were grouped around 30 cm., about 12 inches, but more rock bass were larger than 30 cm., and more kelp bass were smaller. The largest fish measured, however, was a kelp bass 50 cm. or almost 20 inches in length. Probably the size range for both species is about the same but the commercial fishermen do not take the smaller rock bass and therefore this species averages larger in size in the commercial catch than does the kelp bass.

SUMMARY

This brief study of the commercial fishery for rock bass shows that the fishery occurs in southern California only and that the major part of the catch is landed in the San Pedro district.

Heaviest fishing takes place in the summer months.

Approximtely 400 boats catch bass at some time in the year but 95 per cent of these boats take bass only incidentally when fishing for other species. The other 5 per cent deliver almost half, 47 per cent, of the total annual catch of about 500,000 pounds.

All types of fishing gear take rock bass but the highest percentage is caught on hand and set lines.

A measure of supply based on the catches of 9 selected boats indicated no significant increase or decrease in availability.

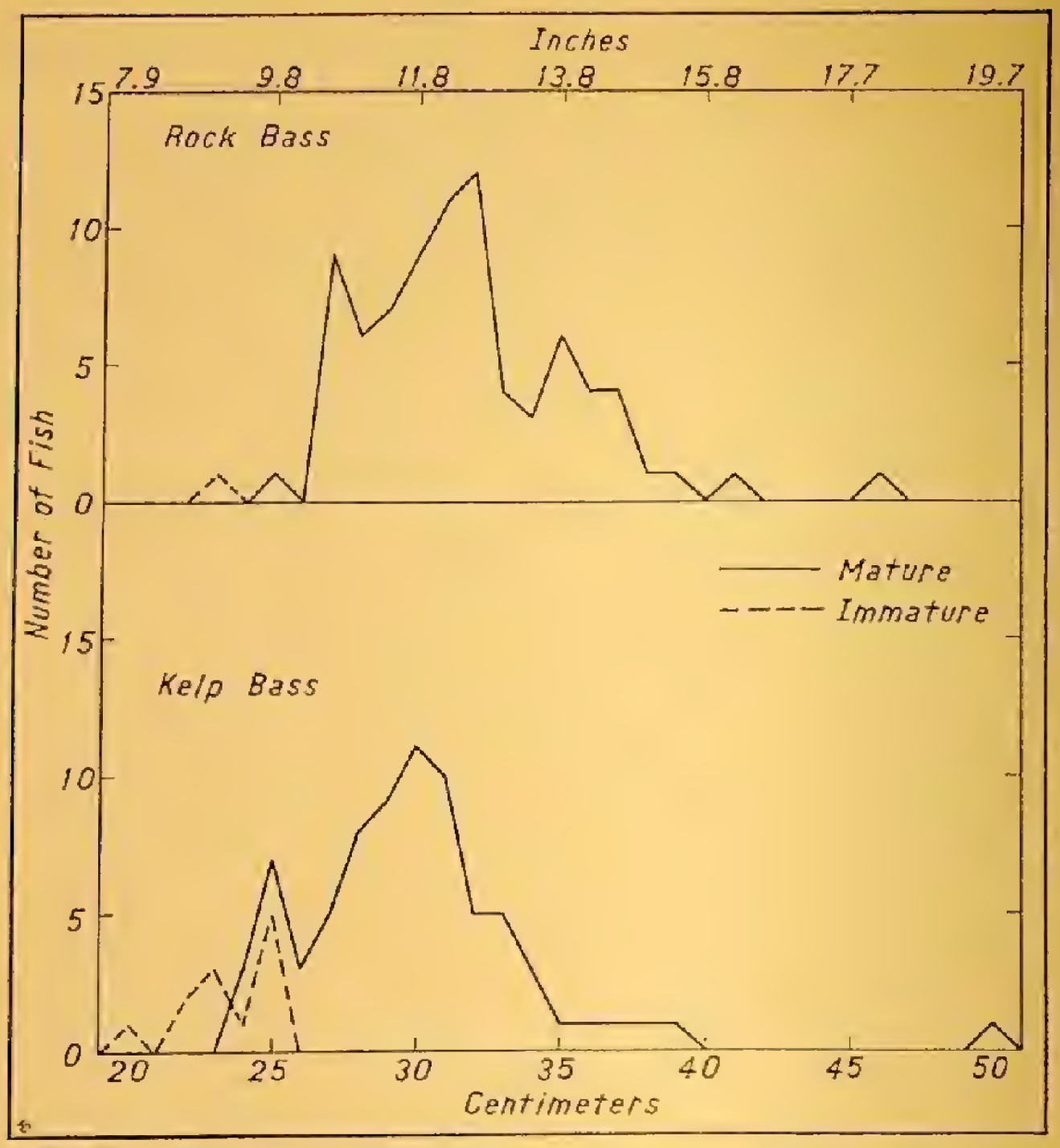


FIG. 16. Size distribution of rock and kelp bass in the San Pedro wholesale fish markets.

Two species, *Paralabrax nebulifer* (rock bass) and *P. clathratus* (kelp bass) comprise the catch but the kelp bass furnishes the larger proportion.

Spawning for both species occurs in June, July and August and both species mature for the first time at about 25 cm. or 10 inches.

RECOMMENDATIONS

As the bass fishery is merely incidental to all but 5 per cent of the commercial boats catching bass, closing these species to commercial fishing would work very little hardship on the industry, but neither would it accomplish much for the conservation of the species. The 5 per cent of the boats truly engaged in bass fishing take less than half of the entire landings and closure of bass to the commercial fishermen

would decrease the catch by only about 250,000 pounds yearly. The remaining poundage would still be caught unavoidably, and if illegal, would in most cases be thrown overboard dead. This would not help to conserve the bass and would mean an economic loss both to the fishermen and to the public.

Because a law conserving only 250,000 pounds of fish annually and causing wastage of an additional 250,000 pounds would do little to increase the bass supply and would be economically unsound, we recommend that no steps be taken at present to withdraw rock and kelp bass from the list of fishes available to the commercial fishermen.

THE BUREAU OF FISH CULTURE CONVENTIONS

By A. E. Burghduff

IN CARRYING out the Bureau of Fish Culture's plan of establishing a uniform system of hatchery operation and accounting, a convention of hatchery employees from the northern counties was held at Mount Shasta Hatchery October 10th and 11th and from the southern counties at Fresno November 2d and 3d. This plan is being established by the Bureau in cooperation with the U. S. Bureau of Fisheries and has for its purpose, first, systematizing hatchery procedure; second, accurate determination of hatchery output and, third, more efficient distribution and planting based upon a better knowledge of water possibilities.

This may seem to be an ambitious plan but as successful achievement is attained through continuous development so may we with a proper start and a definite goal more quickly attain a degree of achievement which will assure better results from our reproduction operations.

The first step in putting such a plan into operation was to acquaint the Bureau's personnel with detail requirements and through their reaction develop a working scheme. The general idea met with enthusiastic acclaim although many of the working details were the subject of earnest discussion.

The program as outlined and adopted, effective at once, establishes an accurate egg count at the spawning stations, accurately records losses during incubation and continues this loss recording plan through the fry and fingerling stage, and then by a scale or weight count accurately determines the number of fish placed in each planting receptacle.

Information secured through the operation of this plan will determine actual losses during each stage of development and insure the applicant of the actual number of fish received in each can. It will also allow the Bureau to make a study of periods during which excessive losses occur and through anticipation prevent recurrence of such losses.

This development in fish culture procedure will not result in producing less fish but will place California in the forefront with states

which accurately determine their propagation losses and the number and size of fish planted.

During these convention sessions different hatchery men were assigned definite subjects for discussion and after they had finished each topic was taken up from the floor for general consideration. This method of considering individual details of fish culture procedure brought out the many methods pursued at different hatcheries and will eventually result in the acceptance of the best practices for general use at all hatcheries.

Some of the hatchery personnel were dubious of a change in the method of counting fish, believing the present displacement measurement to be sufficiently accurate. After the inaccuracies of this method had been considered and a full explanation made of the scale or weight method of measurement it was unanimously agreed to be more accurate and equally as fast as the present practice.

In order to successfully combat diseases which occur among fish confined in limited space at the hatcheries the Bureau will have a man skilled in the art of classifying and controlling bacteria and other causes of fish ailments. Loss records, water and food supply and a study of bacteriological conditions will enable the correction of and prevent the recurrence of diseases which sometimes reach epidemic proportions where fish are confined in hatcheries or ponds.

Dr. Snyder, chief of the Bureau, returned recently from an extended investigation trip through the central and eastern states. He visited many hatcheries and observed methods of procedure and types of equipment used. This information is making it possible for California to adopt such of these practices as will add to the efficiency of our present operations. Dr. Snyder concedes that each state's conservation problems are primarily local in character and must be treated individually to procure best results. He returned from this trip with the information that fish cultural practices in California, while differing in detail, are equally as efficient and modern as any encountered during his inspection tour.

The beneficial results of a full discussion of hatchery problems together with the establishment of an accurate recording system and an opportunity to profit by adopting the best methods pursued in other states will reflect favorably upon our hatchery efficiency. It is expected that eventually distribution problems can be placed upon an equally stable plane wherein only suitable waters will be stocked, proper species selected and diversion of allotments eliminated.

Coupled with these changes in our hatchery and planting procedure is a stream and food survey program administered by U. S. Bureau of Fisheries representatives which will eventually provide reliable data upon which to base stream and lake allotments.

This comprehensive program can not be accomplished in one season and probably not in many years but a fair start is half the battle and the Bureau of Fisheulture anticipates the hearty cooperation of the division's other bureaus in putting the contemplated plan into full operation.

THE LIFE HISTORY OF THE CALIFORNIA BARRACUDA AND ITS BEARING ON THE CONSERVATION OF THE FISHERY

By L. A. Walford

THERE are almost as many fascinating stories in books about barracudas as there are about sharks. One reads about their alleged extraordinary speed, their voraciousness, their peculiar food properties. What many people do not realize is that there are at least twenty kinds of barracudas distributed in different parts of the world's tropical seas. These differ from each other in all sorts of respects, from size and details of anatomy, to behavior and habits. On the Atlantic coast, for example, from Cape Cod to Bermuda, occurs the northern barracuda, a small fish which scarcely exceeds a foot. Off the west coast of Africa, and in the Indian Ocean, another species of barracuda (*Sphyraena jello*) has been described as attaining a length of ten feet. Most of the man-eating stories are about the south Atlantic species, which do indeed seem to attack persons when they get the chance, judging from a long collection of testimonials dating back three hundred years. There is also a persistent belief about these south Atlantic barracudas that their flesh is poisonous, a notion probably started by victims of ptomaine poisoning.

Of all the barracudas, the one found along the California and Lower California coasts is not only commercially the most important, but also of the finest food quality. During the warm months, from March until October, schools of these fish appear along the coast at least as far north as Ventura County, and are taken in large quantities—five or six million pounds a year—by gill netters, purse seiners and jig fishermen. As the season draws to a close, during the latter part of September and the beginning of October, the fish seem to retreat gradually into deeper water. Suddenly they disappear from the range of fishing activities along the California coast. Whether they merely move offshore into deeper water for the cooler months or whether they migrate south to Lower California is not known. At any rate, schools of barracuda occur along the Lower California coast during the winter, and are taken from there by our purse seiners at the rate of almost two million pounds a year.

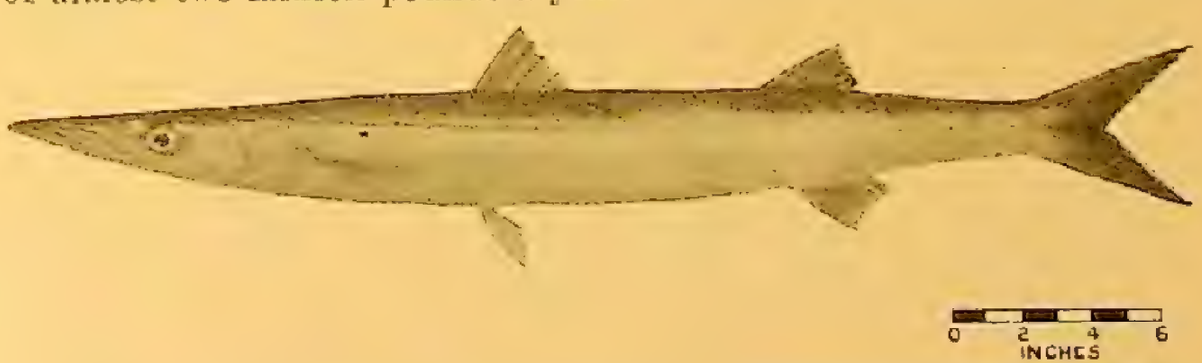


Fig. 17. Barracuda (*Sphyraena argentea*). (Photo by the Mott Studios, Los Angeles.)

Whatever the direction of the spring migration may be, it is evidently a "spawning migration," since barracuda are taken locally only during the spawning season, which reaches its height in May and June. Judging from the evidence collected, the females spawn several times during the season, making each time a migration to the spawning grounds and a subsequent movement away. The males evidently remain in the vicinity of the spawning grounds throughout the season. At each spawning, the females deposit approximately from 50,000 to 500,000 eggs, depending on the size of the fish. The eggs are given off directly into the water, are fertilized by the males, and drift helplessly with the currents until some time after they hatch, when the young fish become able to swim.

The bulk of the fish hatched in the San Pedro region appear as a fairly homogeneous group as early as the end of July, when they average between three and one-half to four inches in length. They grow rapidly until December, and slow down considerably during the winter months. During this period, not only the bodies of the young fish grow slowly, but also their scales. In the spring, growth again speeds up, and a scar is left on each scale, which marks the point where this new spring growth is resumed. At the end of their first complete year of growth, barracuda average about fifteen inches.

By counting the number of yearly scars found on a barracuda scale, one can judge the age of the fish with fair accuracy up to the sixth year. Thus, something of the further life history has been traced. In their second year, almost all of the males spawn, only 75 per cent of the females; in their third year, all the males and females spawn. Although such early maturity seems to facilitate protecting the barracuda from overfishing, the fact is, the first two or three years of spawning produce only a small quantity of eggs and sperm, since these products increase in amount with growth and age. Consequently, these first years of slight spawning alone are, compared to the latter years, of inconsiderable value to the barracuda population.

At present, the law protects fish under three pounds. A barracuda attains this weight in from four to six years, usually five years. As the present law works out, however, the three-pound limit really protects only the one, two and three-year-old fish. By increasing the size limit slightly, all of the four, and part of the five-year-old fish would be protected, and at least one good spawning season for each fish would be assured.

The economic soundness of leaving fish in the water until they are large enough to be worth marketing is often overlooked by commercial interests in their efforts, on economic grounds, to defeat such proposed legislation as a size limit. A fish grows in length rapidly during the first two years, slows down gradually in rate during succeeding years. Growth in weight, on the other hand, is slow at first, more rapid later. If fish were sold by the yard, three or four inches would not make much difference in price. But such is not the case: they are sold by the pound, and in a large fish like the barracuda, a slight difference in length may mean a considerable difference in price. A barracuda 25 inches long is worth 16 cents at 8 cents a pound; at 31 inches, it is worth 32 cents. The additional 6 inches are worth as much as the

first 25. These facts are shown graphically in figure 18, where the weights and values at various lengths are represented.

There is, of course, a limit beyond which postponing capture does not pay. This limit is determined by the amount of natural mortality

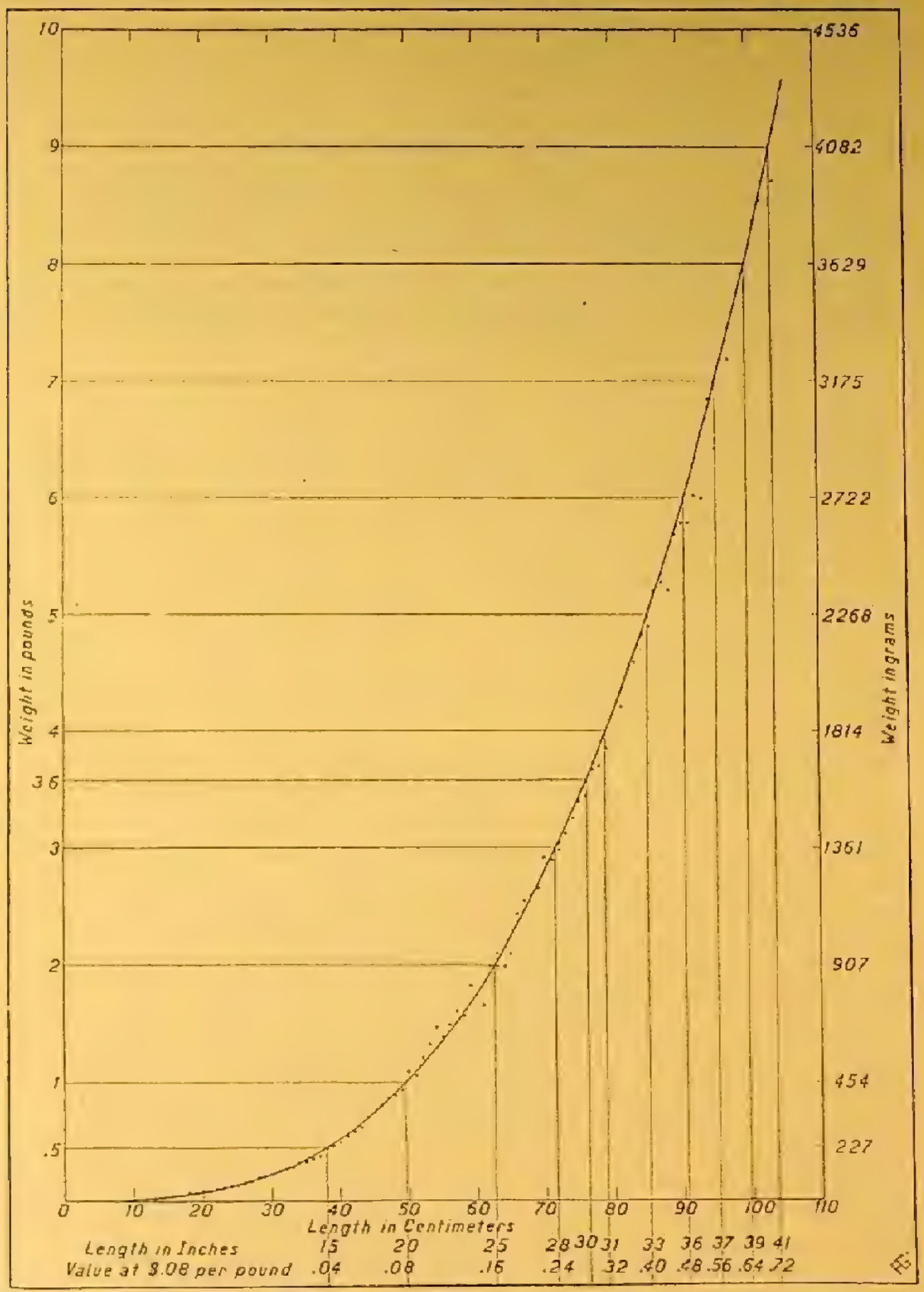


FIG. 18. Showing the calculated weight at each length and the value at eight cents per pound. The original observations indicated by the black dots, are fitted by the method of averages.

which occurs—an unknown quantity. Judging from the commercial catch, which may or may not reflect the true conditions of the population, there is no sharp jump in mortality between the third and sixth years. A size limit of 30 inches, which amounts to only 1.7 inches more than the equivalent of the present limit, would protect the four-year-old fish and some of the fives, a point by no means unreasonable. There has so far been no evidence adduced to support an argument for catching the fish before they have had at least one *good* spawning year, and before they have obtained a weight which pays for the labor of catching, cleaning, icing and shipping.

A detailed report of a study of the life history of this fish, including a discussion of the methods used and an extensive bibliography of articles on barracudas of the world is given in "The California barracuda (*Sphyraena argentea*)," by L. A. Walford, a recent (1932) publication of the California State Fisheries Laboratory, issued as Fish Bulletin 37. This may be obtained by writing to the Division of Fish and Game, 450 McAllister Street, San Francisco; price, 20 cents.

REPORT OF THE COMMISSIONERS OF FISHERIES OF THE STATE OF CALIFORNIA FOR THE YEARS 1870 AND 1871

REPORT

To His Excellency, H. H. HAIGHT, Governor of California:

The Commissioners of Fisheries for the State of California, appointed under an act of the Legislature, entitled "An Act to provide for the restoration and preservation of fish in the waters of this State," approved April second, eighteen hundred and seventy, respectfully submit their first biennial report.

REPORT

California has a seacoast extending through ten degrees of latitude, and a shore line of nearly eight hundred miles. The Coast Range of mountains, which adjoins the coast line for the greater part of this distance, creates by its western watershed nearly one hundred streams and rivers emptying into the Pacific Ocean. These streams and rivers vary from twenty to sixty miles in length. The drainage of the western slope of the Sierra Nevada, through seven degrees of latitude, forms several hundred streams, whose united waters make the Sacramento and San Joaquin rivers—the first navigable for a distance of one hundred and eighty miles, and the last navigable one hundred miles from the ocean. The waters from the eastern slope of the Sierra Nevada flow into brackish and salt lakes, in the State of Nevada, having no outlet into the ocean. Pyramid, the largest of these lakes, receiving the waters of the Truckee River, is forty miles long and twenty miles wide. The inland bays and fresh water lakes of California cover more than six hundred and fifty square miles—an area half as large as the State of Rhode Island.

These few statistics are given that it may be clearly understood how extensive is the field over which, under the law, the Board is expected to prevent the wanton destruction of fish and required to compel the owners of dams to permit the free passage of fish to their native spawning beds. When it is further understood that the members of the Board neither receive nor expect compensation for their services other than the satisfaction of doing something towards the preservation of the fish now in our waters and adding to the food supply of the people by the introduction of new varieties, it will be acknowledged that if but a beginning has been made in this work, at least public attention has been called to the importance of the subject. If a few men of intelligence, living on the banks of each bay, river, and lake, will inform themselves of what has been done in other states and countries for the propagation and preservation of fish, they will create a public opinion that will cause the enactment of proper laws and compel their enforcement. The result will be that after a few years our river fisheries will be largely increased, giving employment to a large number of men, and furnishing a cheap supply of nutritious food to many more people.

FISH WAYS

The most important means for the preservation of the fish now in our rivers, is in the construction of fish ladders over all dams otherwise impassable. Even traps, seines, and spears will not utterly destroy the fish if some few are permitted to reach their natural spawning beds. It is the instinct of all anadromous fish, after leaving the ocean, to seek the particular stream or rivulet in which they were hatched to deposit their eggs. To reach the particular spot and the parent bed of gravel they will make every effort. Where impassable dams have been placed across the streams, the fish will come year after year and leap by the hour to scale the falls until utterly exhausted. If no means are provided by which the fish can pass the dam, in three or four years the stream above the dam will be without fish. A fish ladder is ordinarily so simple and inexpensive an affair that it would seem that men owning dams would, if informed, construct them without the requirements of a compulsory statute. A good fish ladder for use on our mountain streams is made in the form of a long box of plank, open at both ends, four feet wide and three feet high. One end of the box is fastened at the top of the dam, the other end is extended to and fastened in the center of the pool below the dam. In the inside of the box and fastened on its bottom are pieces of plank about four feet apart, placed transversely, and called "riffles." Each riffle is about a foot high. These riffles do not extend from side to side of the box, but only about two-thirds across. To illustrate: if the first riffle is fastened on the right side of the box at a right angle to its side, it will extend thirty inches across the box; the next, four feet above, will be fastened on the left side of the box and extend thirty inches across it; and so on, alternately, until the top is reached. The water passing into the top of this box is caught by these riffles and diverted right and left by them until it reaches the stream below. The fish coming up the stream to the dam seek and explore every crevice and opening where water is passing. If the lower end of the fish way is placed near the center of the pool below the dam, they readily find it, and immediately enter it. Even if the ladder is placed at so great an angle as forty-five degrees, the fish have no difficulty in passing through it; they will jump through almost any current a distance four feet, and each riffle gives them a resting place behind which they recover for the next jump. At one dam on a tributary of the Truckee a mill owner consented to put in a fish way, at the earnest solicitation of one of the Commissioners, and to prevent the expenses of a suit. He said the law was an infringement of his rights, and when the Legislature passed an act to compel him to spend money in such foolish business they should have appointed a schoolmaster to teach the trout how to use the contrivance; he did not believe a fish could be coaxed to go near it. The next evening after the fish way was placed in position the fish were passing it every few minutes; the mill owner became a convert to the practical use of fish ways. He soon tore away the cheap and temporary affair built to comply with the law under compulsion, and has erected in its place a substantial ladder that will last for years. A fish ladder is but an artificial imitation of the means by which river fish in their annual migration pass up rapids. After reaching the foot of a rapid the fish rest; they will then suddenly dart up the stream and seek shelter in the slack water behind some rocks; here, after more rest, as if to recover strength for the next great exertion, they will dart again and get behind another rock; and so on, until the rapid is passed. From the description given of an ordinary fish ladder, it will be seen that they are easily built and that the cost is but a trifle. The average cost of all fish ladders in Maine, including permanent stone structures over manufacturing dams, does not reach two hundred dollars. Many statistics have been kept showing the increase of fish as a result from the construction of fish ladders, especially in Great Britain. As an illustration, I quote from the report of Charles G. Atkins, Esq., Fish Commissioner of Maine. In comparing the salmon fisheries of Europe with those of Maine, he says: "Their fisheries were nearly exhausted through excessive fishing and the erection of barriers, and by a careful management, including the construction of fish ways, have been made to yield large returns. I will instance the river Galway in Ireland. The salmon fisheries of the Galway are owned

by Thomas Ashworth, who came into possession of them in eighteen hundred and fifty-two. They were in an exhausted condition. Mr. Ashworth had good fish ways built over the dams, of which there was one at the head of the tide; had fishing restricted and protection given to the fish on their breeding grounds. What success attended his efforts is shown by the annual catch as exhibited in the following table:

Year	Salmon
Eighteen hundred and fifty-three	1,603
Eighteen hundred and fifty-four	3,158
Eighteen hundred and fifty-five	5,540
Eighteen hundred and fifty-six	5,371
Eighteen hundred and fifty-seven	4,857
Eighteen hundred and fifty-eight	9,639
Eighteen hundred and fifty-nine	9,240
Eighteen hundred and sixty	3,177
Eighteen hundred and sixty-one	11,051
Eighteen hundred and sixty-two	15,431
Eighteen hundred and sixty-three	17,995
Eighteen hundred and sixty-four	20,512

"Thus the produce of this fishery rose in twelve years from one thousand six hundred and three to twenty thousand five hundred and twelve, and this in spite of a dam at the head of the tide, where five-sixths of all the water is used by mills and canals, only the *one hundred and sixtieth part* running through the fish way, where all the salmon must pass; in spite of civilization, in spite of the disappearance of forests and the cultivation of land. The fish way through which pass all the salmon that ascend this river is supplied with water by a gate two feet square, and through this aperture forty thousand salmon are estimated to have passed in one year."

The law, so far as it relates to fish ladders, appears to operate satisfactorily. Thus far all mill owners on the Truckee and its tributaries, whose dams obstruct the passage of fish, have, with one exception, constructed fish ways. The Commissioners have furnished many mill owners with plans for the construction of fish ways. From our experience during the past two years, it would seem that as a rule the mill owners, with but few exceptions, are a body of intelligent men, who only require to have made clear to them the fact that the construction of fish ways does not interfere with their business, while it adds to the public good, to induce them to place fish ways over their dams.

SALMON

The salmon is the most important visitor to our rivers. It has appropriately been called the "king of fish." The richness of its flesh, its large size, the certainty of its annual return from the ocean, the rapidity with which, under favorable conditions, it is multiplied, all render it an important article of human food. It has probably been the chief source of subsistence to more people than any other fish. The question as to whether the number of salmon is gradually decreasing in the Sacramento and San Joaquin Rivers seems difficult to be answered. Some of the fishermen contend that it is, and others point to the catch of eighteen hundred and seventy in proof that it is not. There are no fish weirs to trap them, and but few dams on the tributaries of these streams to prevent them from reaching their spawning beds. The weight of testimony is on the side of those who believe the quantity to be decreasing; and the most intelligent of the fishermen are so firmly convinced of the fact that they ask that a law be passed and enforced to prevent, for a certain period, the catching of fish while they are filled with ripe spawn. But there is no concurrence as to when this "close time" should be. The fishermen in one part of the river say it should be at one time, and the fishermen in other parts say it should be at others. When the great army is passing by Rio Vista, it would be, in the opinion of the fishermen of Rio Vista, a proper season for a close time at Sacramento and Tehama; and when this army has reached Sacramento, it would, in the opinion of the Sacramento fishermen, be a proper season for a close time at Rio Vista and Tehama. What would be just to all the fishermen, and give the next generation a chance to eat this delicious food, would be to prohibit, by strict law, rigidly enforced,

the catching of salmon by any process during twenty-four hours each week; say, from midnight of Saturday to midnight of Sunday. Probably the most serious cause for the decrease of salmon in our rivers arises from mining. It is the most serious, because it can not be remedied. Formerly salmon were plenty and largely caught by the Indians in Feather River, in the Yuba, and in the American; but of late years they have ceased to visit these rivers. It is not because the waters of these rivers are muddy. All migratory fish that seek rivers in which to deposit their spawn, do so in the season when the freshets cause the water to be muddy. They will pass through muddy water, if beyond they find clear water and clean gravelly bottoms. The gravel beds that formerly existed in these streams are now covered with a deposit of mud, washed down from the mines; and on this the eggs of the salmon will not hatch. Neither will the eggs of the salmon or trout hatch in water containing any considerable quantity of sediment. A small quantity of the finest sediment deposited on the eggs prevents it from hatching.

Salmon, after the second year from being hatched, pass the greater part of the time in the ocean; they there find their principal food. While in fresh water their growth is slow, in salt water they increase in size and weight with great rapidity. They can only breed in shallow streams of cool, fresh water, such as they find in the tributaries of our rivers descending from the mountains. To such places they annually resort; and to reach them, they will make the most extraordinary exertions. Salmon are caught by the Indians in the small streams that empty into the Sacramento from the sides of Mount Shasta, at an elevation of more than four thousand feet above the level of the sea; to reach which they must have passed through at least fifty miles of almost continuous rapids. Bishop Farr states that salmon are also caught in the headwaters of Snake River, east of Salt Lake. As Snake River is a tributary of the Columbia, these fish must annually make a journey into the interior of more than a thousand miles from the ocean.

Some breeding fish enter our rivers during the summer, but they do not deposit their eggs until late in the autumn. During the time they remain in fresh water they lose in weight, and the quality of their flesh deteriorates; its color becomes nearly white, and it ceases to be firm. The great army arrives in our rivers after the first heavy rains. Upon arriving they seek the brackish water in the vicinity of where the salt and fresh waters meet. Here they remain for several days, or perhaps weeks. It is supposed that the brackish water kills the small parasites which attach to them in the ocean. It is this instinct that retains them in brackish water that gives to Rio Vista its prominence as a fishing point.

The salmon, like most other fish, reproduces its kind from eggs which are extruded from the female fish in an undeveloped and infecund state. The male fish performs his office of fecundation after the eggs are in the water. It is a remarkable fact, that the salmon will return, year after year, to deposit its spawn in the particular stream in which it was hatched. Salmon hatched artificially in Scotland and kept in breeding ponds, were, for several years, marked before being dismissed to the ocean; the salmon, thus marked, invariably returned to the stream in which they passed their infancy, and, so far as is known, these marked salmon have never been taken in any other river. The pair having arrived in their parent stream, find a gravel bed, where the water is clear and cold. The female burrows a hole in the gravel about four inches deep, and of a diameter nearly equal to her length, then pressing her body against the upper edge of the hole, the eggs are extruded and fall into this nest. The male, who is in close attendance, extrudes his milt into the water which flows over these eggs, and they are thus fecundated. The female immediately busies herself in covering the eggs with the gravel. This process is again repeated in a few days, as more eggs become ready for extrusion, until the season's work is over, when the fish return, poor and thin, and, after remaining for a short time in brackish water, leave for unknown places in the ocean, to return the following season, largely increased in weight. The only condition requisite for the hatching of the eggs is that cool, pure water, free from dirt or sediment, shall constantly pass over them. In from ninety to one hundred and thirty days the young fish are hatched. For the first twenty or thirty days they require no food,

other than the yolk sac which is attached to them. The young fish remain in the river from one to two years before leaving for the ocean. It has been observed in Scotland, where the artificial breeding of salmon was first largely practiced, that of a given quantity of eggs hatched in one season, about one-half the young fish would leave for the ocean the same year, while the other half would remain until the following season. This has been found to be the unvarying rule. No reason has been assigned why this migratory instinct should control but about half the young fish in the year in which they were hatched, other than that Providence, while apparently not caring for the individual, makes stringent laws for the preservation of the species.

The preservation of our salmon fisheries is a subject of great importance. Salmon were formerly as abundant in the rivers of New England as they are now in California and Oregon; but traps, weirs, ponds, seines, gill nets, and the erection of dams without fish ladders, at last nearly exterminated them. Now these states are making appropriations for the artificial hatching of these fish, and the rivers are being successfully restocked.

So much more is known of the habits of the salmon than formerly, that it is not difficult to determine what may be done to increase the number of fish, and at the same time increase the quantity that may be caught. The men who pursue the business of fishing for salmon, appreciate the necessity for their preservation and acknowledge the propriety of laws requiring a "close time," as well as laws against pounds and weirs, and laws regulating the size of gill nets. We believe the time has arrived when the present and future interests of California require careful and just legislation. We would, therefore, recommend that a standing committee be appointed in both houses of the Legislature on coast and inland fisheries. These committees could visit the fishermen, and, after learning their views, so amend the present law and frame new laws as to protect legitimate fishing, and at the same time provide for an increase of fish in the future.

TROUT

This fish is found in nearly all of the streams that discharge into the Pacific Ocean from the Coast Range of mountains and in the greater number of the mountain streams of the Sierra Nevada. They vary greatly in size and appearance in different waters and at different seasons, but so far no variety is exactly similar to any of the brook trout of the New England states. The large brown and silver trout of Lake Tahoe and the Truckee River are pronounced by Mr. Seth Green—who is considered to be an authority in such matters—not to be trout, but species of the sebago or land-locked salmon. These fish make annual migrations from Lake Tahoe to the brackish waters of Pyramid Lake. Many of the fishermen of Tahoe insist that the so-called silver trout does not leave the lake, but as they are occasionally caught in the river, it is probably they also migrate, but perhaps at an earlier or later season. The habits of the trout are similar to those of the salmon. It seeks a bed of gravel or coarse sand in clear running water, near the head of a stream, burrows a nest and covers its eggs. In the streams of the Coast Range of mountains the trout spawns in November and December; in the streams of the Sierra Nevada in March and April. Trout will also spawn and the eggs will hatch in lakes which are supplied by springs that rise in the bottoms. In this case they will deposit their eggs among the gravel where the spring rises, the motion of the water from the spring having the same effect in bringing the eggs to maturity as the water. It has been observed that there are no trout in our mountain streams above large falls. The trout will migrate from one part of a stream to another. If there were ever trout above these falls they would pass below them in their migrations, and the falls prevent their return. In many places a very little work would create a passage for the fish, which would have the effect of greatly increasing the numbers of this most delicious species. The reports of our assistants, from which we have largely copied, will show how rapid has been the destruction of the trout in this State. It is to be hoped that the dissemination of intelligence as to the construction of fish ladders and the enforcement of the law against trapping and illegal fishing, as well as the

stocking of streams and lakes in which no trout were found, and the restocking of those from which they have disappeared, will have the effect to repair the waste that has been committed. It having been noticed that on many streams on which there were sawmills, the trout after a few years disappeared, it was supposed that the floating sawdust in some manner killed the fish, but as in other streams on which there had been sawmills for years there were still trout to be found, the Maine Commissioners devoted much investigation to solve the mystery. They found that trout readily swam among the floating sawdust, and never seemed to avoid it. At last they ascertained that where the mills were below the gravel spawning beds of the trout the fish were still plenty, but where the mills were above the fish had ceased to be. Wherever the sawdust had sunk and covered the spawning beds, the trout, after a few years, had disappeared, for the trout has the same instinct as the salmon—it returns to spawn in the particular stream in which it was hatched.

Canada, which is in advance of most of our states in her laws for the preservation of her fisheries, forbids, under penalties, all sawmills from running sawdust into the streams. In a short time it will be requisite to pass similar laws in this State, for, in addition to the destruction of trout, the sawdust will cover the spawning beds of the salmon as effectually as the mud from mining has their gravel beds in the American, Yuba, and Feathers rivers. On the Truckee River, about five miles above the town of Truckee, the Brothers Comer have an establishment for the artificial hatching of trout. They have been engaged in this business for the past three years, and have successfully hatched and have in their ponds more than half a million of fish. Their business is a success in every respect except financially. There is not in this State, as yet, a large demand by individuals for the young trout to stock streams, and the feeding of so large a number of fish kept in small ponds requires a considerable outlay. The commissioners have been requested to expend some portion of the appropriation at their disposal in purchasing a part of these young fish to be placed in streams that are now without trout. It would be an appropriation of money within the spirit of the law, but there is some doubt as to whether the wording of the act authorizes this kind of expenditure. Several of the states have hatching houses in which various kinds of fish valuable for food are hatched, and distributed to all who desire to stock lakes and streams. The destruction of our native fish has not gone so far that a similar plan is required in California, but we believe it will be found that the drought of the past two years will have had the effect of materially decreasing the trout in all the streams. The sand and gravel beds at the heads of streams where they deposit their spawn must, to a great extent, have been bared by the receding water before the eggs came to maturity.. If authorized, we will expend a portion of the appropriation in purchasing young fish to be distributed to restock streams, or to place in streams and lakes which have no trout in them.

The Comer Brothers procure their eggs for hatching from the fish caught in the small streams that discharge into Lake Tahoe. Their plan of operation is similar to that of other breeders of trout. Having caught a number of trout, male and female, at the season when they commence to go up stream, they are kept in a small trap or pound until the females are found to be ready to deposit their eggs. This can be readily told by an examination of the fish. The first operation is to procure a tin pan or other shallow vessel of water, a male trout is then taken from the pound and his belly placed in the pan, a gentle pressure of the hand will express a few drops of the milt; he is then returned to the pound; a female trout is then taken, and by the same process her eggs are also expressed into the same pan. The water in the pan is then gently stirred so as to insure all the eggs coming in contact with the milt. In a few minutes the water containing the milt is washed away and replaced by pure water. These impregnated eggs are then placed in the hatching boxes, which are a series of shallow wooden boxes nearly filled with fine gravel, over which a stream of pure cool water is slowly but constantly passing. A trout yields from five hundred to four thousand eggs, depending upon its size and age. A salmon yields an average of a thousand eggs to each pound of its weight. The eggs are spread upon the gravel, and after the water has continuously passed over them for

from forty to eighty days, depending upon its temperature, the young trout make their appearance. They require no food for the first thirty days, the yolk sack of the egg, which is attached to them, affording nourishment during this period. After this, the Messrs. Comer feed them on finely chopped liver until they are sufficiently large to be turned into the ponds, where they are fed upon any kind of coarse meat or fish, finely chopped. Trout will live and thrive in water of a temperature between forty and sixty-five degrees. This is about the only question to be settled by persons who desire to stock streams with trout. If the water in summer does not get warmer than sixty-five degrees, the experiment may be tried with every probability of success. The quality of the water does not seem to be material. They live and thrive in water that is impregnated with minerals, and in salt water, and in artesian well water, provided only the temperature is not too warm. Persons who live near small lakes and streams, now without fish, and containing water of the proper temperature, could, at trifling expense and care, provide themselves with a constant supply of delicious and healthy food by hatching a few eggs, or by turning in a few of the young fish. Both eggs and young fish are readily transported almost any distance. Salmon eggs have been taken from Scotland to Australia and hatched, and the Acclimatization Society of San Francisco has successfully imported the eggs of the Eastern brook trout and hatched them in this State. It has been estimated that an acre of water can be made to yield as much food as four acres of average land.

SHAD

Your Commissioners made arrangements with Mr. Seth Green, the noted pisiculturist of Rochester, New York, for the importation of a lot of young shad to be turned into the Sacramento River. No shad proper (*alosa praestabilis*) are found in the rivers of the Pacific Coast, while there are found several varieties of the same family, such as herrings, anchovies, and sardines. As shad readily enter rivers while muddy from the spring freshets, and spawn in water of a temperature as high as sixty-five degrees, there was reason to hope that if the shad could be brought here alive and turned into the river they would find suitable food, and in time go to the ocean and return to propagate their species. As the shad is very prolific, each full grown female yielding from fifty to eighty thousand eggs, and as the flesh is esteemed to be nutritious and valuable food, it was deemed proper to make the first experiment of importing new varieties with the young of this fish. The eggs of the shad are hatched in from two to four days after they are spawned, therefore, if there were no other reason, time alone would prevent the importation of the eggs.

Mr. Green felt so much doubt as to the possibility of transporting the young fish for so great a distance that he determined to superintend the experiment in person. He left Rochester, New York, with an assistant, on the twentieth of June, with fifteen thousand of the young fish just hatched, contained in eight tin cans holding about twelve gallons of water each. The water had to be changed at every convenient opportunity, and as on a part of the journey the weather was quite warm, constant attention had to be given to prevent the water in the cans from reaching a higher temperature than eighty degrees. At Chicago he lost a few fish from a film of oil from the machinery of the waterworks with which the water attempted to be used was covered. At Omaha the river water killed a few; the cause of this he had not time to investigate. The water of Bear River (discharging into Salt Lake) and the waters of the Humboldt and Truckee rivers were found to agree with them and containing plenty of food. Mr. Green arrived on the twenty-seventh of June. As it was advisable to put the young fish in the river at as high a point as was practicable, for the reason that the instinct of the shad is, like that of the salmon, to return to spawn at the same place where it was hatched, they were the same day transferred to the cars of the California and Oregon Railroad and taken to the Sacramento River at Tehama. Here the temperature of the water was found to be sixty degrees of Fahrenheit. Upon dipping up the river water in a glass and pouring a lot of the young fish into it, they were found to be lively and the water to contain large quantities of some minute substance on which they feed. All the conditions being favorable, they were turned loose in their new home. It is expected

they will remain in this river until about January, by which time they will be three or four inches long; they will then go to the ocean, to return the next year weighing from a pound to a pound and a half, ready to commence the increase of their kind. Thus far the experiment has been a success. The water of the river is adapted to them; it contains the proper kind of food for their young, and the waters of our coast are filled with the sand flea, a small species of the shrimp, on which the fish feeds after reaching the salt water. The only thing to be feared is that there may be in the ocean some kind of fish which may so completely exterminate them that none will be left to come back and spawn. If after one or two years even one shad is taken in the river, the result will be satisfactory, as it will demonstrate the fact that all the conditions are favorable to their successful propagation in the waters of our rivers; we could then at trifling expense fill our waters with this valuable fish. When first hatched, and in a condition proper to be transported, one freight car would bring over two million of them. If, after two years, none should be taken, it would not then be well to abandon the experiment.

The English, year after year, shipped impregnated salmon eggs to Australia; the eggs hatched, and the young fish in due time went to the ocean; but for years none were found to return. Some fish—supposed to be the bonita—destroyed them all. At last, after repeated experiments, some escaped, and in eighteen hundred and sixty-seven, large fish, returned from the ocean, were taken in the river. Shad were formerly plentiful in all the rivers emptying into the Atlantic Ocean from Georgia to the St. Lawrence. They, therefore, frequent warmer waters than the salmon. Over-fishing, traps, pounds, weirs, small meshed seines, and dams without fishways at last nearly exterminated them. Through the efforts of the Fish Commissioners of the several eastern states they are again becoming plentiful. For a number of years all efforts at the artificial hatching of the eggs of shad had been failures. It was ascertained that the fish came into the rivers at about the same time as the salmon, but that unlike that fish, they did not spawn until the warm summer months. Their eggs are not placed upon gravel, but float in the water. Schools of them will play about the river for days, when, upon some sudden impulse, the milt from the male and the spawn from the female will be exuded into the water, at times, it is said, making the water cloudy. In from two to four days the eggs hatch, when the young fish immediately swim for the center of the river, keeping their heads against the current. At last Mr. Seth Green, after much patient investigation and numerous experiments, invented a box, the bottom of which was covered with fine wire netting. On this wire netting the impregnated eggs were placed; a series of these boxes, fastened together by a rope, were allowed to float in the current of the river. To the sides of each box were fastened, at an angle, pieces of board, which, floating in the water, caused the wire bottom of the box to be partially turned against the current. The effect was that the current, entering through the wire netting, kept the eggs in constant motion. All the conditions of nature were satisfied, and the experiment became a success. Mr. Green obtained a patent for his invention, which, as it is largely used, is quite valuable. Within the past four years, under the direction of Fish Commissioners and by aid of small appropriations, more than five hundred million shad have been artificially hatched in these boxes in the rivers of the eastern states north from Virginia. The result of the first and second year's hatching in the Hudson and Connecticut is becoming manifest; more fish have been taken this year in those rivers than in any year during the past twenty. So many fish were caught that the fishermen were unable to take care of them, and fresh shad were sold in the New York City markets as low as ten cents a shad.

These results, from the experiments of enthusiasts, in increasing almost without expense the food supply of the people, are worthy the attention of statesmen. So much attention is now being given to the subject that Congress has passed a law appointing a commission to investigate our river and coast fisheries, learn the habits of the fish, and report as to what legislation is required to aid in increasing the food supply from this source.

IMPORTATION OF NEW VARIETIES

Your Commissioners have it in contemplation to attempt, at the proper season next year, the importation from the east of white fish from the Great Lakes, to be placed in Lake Tahoe; black bass, a superior game fish, to be placed in some lake to breed and be distributed; eels, to be put in the Sacramento River; and lobsters, to be deposited in some appropriate place in the bay of San Francisco. We have also opened a correspondence with gentlemen in China, with the object of learning what valuable food-fish can be obtained in that country, and the processes of the Chinese, who are said to pursue largely the artificial hatching of fish. From the following extract from one of the letters received it will be seen that the Chinese have not yet learned how, artificially, to impregnate the spawn, but depend upon catching the eggs for hatching after they have been naturally fecundated. Our correspondent says:

"Referring to your letter of May twenty-fifth, inquiring concerning the manner of breeding fish, we would say that we find the Chinese, at certain periods of the year, spread their cloths across the river at some distance above Canton and catch the eggs which are washed down from the smaller streams and ponds higher up. These eggs have been already impregnated by the male fish at the place in which they are laid, and when thus caught are placed in ponds, where after a short time they hatch and are thus raised. There are no breeding ponds near Canton, and it is said to be impossible to breed fish in ponds on any large scale, as the eggs are devoured by the male fish after impregnation unless he be immediately removed, which is impractical where there are any number. The ponds in which the eggs are placed for hatching must be running water. We would suggest the plan of sending two or three men, acquainted with the process of breeding, to California, where they could experiment on the rivers and lakes, which very much resemble those in the country where it is at present practiced."

EXTRACTS FROM REPORTS

Our field is so extensive and there is so much to be done in the way of investigation preparatory to intelligent legislation on the subject of inland fisheries, that we deemed it advisable to employ two assistants—the first, Captain E. Wakeman, to examine and report on the fisheries of the bay of San Francisco and some of the rivers that discharge their waters directly into the Pacific Ocean; the other, Mr. George C. Haswell, to examine and report upon the fisheries of Lake Tahoe and the Truckee River and its tributaries. The following extracts from their reports will be found of great interest. Referring to the bay fisheries, Captain Wakeman says:

"Since the date of my commission I have visited with the yacht 'George Steers,' repeatedly, all the fishing grounds that are frequented by the Italian and Chinese fishermen in the waters of our bay. The only Chinese fishing station that I find is located a short distance north of the 'Two Sisters.' Here, on an extensive mud flat, are stakes or poles set firmly in the ground, and occupying an area of several miles in extent, from which poles are kept constantly set the nets, which are taken up at each slackwater of the flood and ebb tide. From twelve (12) to fifteen (15) boats are employed, having three (3) men in each boat. Shrimps are taken here and cured for the Chinese market by being boiled in large vats in salt water, then spread out on the cleanly swept ground and dried in the sun, being raked over frequently during the day. The scales or skin become separated from the meat and looks like fine sawdust. The meat and refuse is then sewn up in the best quality of bags and placed on board the Chinese junk of about thirty tons and sent to San Francisco, from whence it is shipped to China. Scare any class of fish are taken in these nets but shrimp, and thousands of tons must find their way to China annually. Their nets are similar to those used by the Italians, with this difference, viz: the middle of the net, which assumes the character of a bag, is, with the Chinese, opened by untying a string, and the whole catch is dropped into the boat with ease. The net is then closed again with the string and put back into the water to remain until next

slack. Three of these nets generally load a large boat, which are all of a large and commodious class.

"Saucelito Bay is constantly used by the Italians, smelt being the principal fish, with soles, flounders, sardines, and anchovies. In some cases nothing but crabs are taken, which destroy the nets and irritate the men so that they are inclined to leave them on the beach to die; but I have had, in all cases, everything that was not marketable put back into the water. In fact, crabs are the only fish that are left upon the beach, all other kinds being taken out of the nets with tin pans, the nets being in about from one to two feet of water. All that part of the catch that is desired is taken and thrown into the boat without coming in contact with the sand and dirt, and the small fish are permitted to remain in the water; nevertheless, large quantities of the young fish die from pressure or other cause arising from the fact that they have been compressed as it were among so many thousand into the contracted space of a few feet, and are unable in their most strenuous efforts to release themselves from their perilous condition.

"They are to be found in large quantities, floating upon the water, completely drowned. Still a very large number revive and swim off again. Whereas, heretofore, the custom appears to have been to dump the whole catch upon the beach and, after picking out all they wanted, the young were invariably left upon the beach, becoming, in many parts, a most intolerable nuisance to persons residing in the vicinity. A new order of things has been inaugurated this year, which is found to work to the mutual benefit of all parties concerned. Five boats are generally to be found in different parts of this bay; and fish are taken at all times of tide, both day and night. Two boats are generally employed between the bay and the Golden Gate. They cast on both shores, north and south, for the same kind of fish; and also in Kashaw's Harbor, two and sometimes three boats are found both night and day, at all times of the tide. During the night fires are made upon the beach, and frequently these fires can be seen, not only on all the different beaches in Saucelito Bay and Kashaw's Harbor, but also on both sides of Raccoon Straits, giving a most picturesque and cheerful aspect during the long and gloomy nights which prevail in most parts of our harbor at this season of the year.

"These Italians are a singular and peculiar people, always sober and industrious, and, like the Chinese, they pursue their avocations in silence. During the silent and tedious hours of the night some are found sleeping in close proximity to the fire, with their harness on, face down, which appears to be the universal practice among all classes of the different races of people who are accustomed to sleep upon the ground in the open air. From Raccoon Straits to the Chinese fishing station, on the north shore, are several favorite places where the nets of the Italians are cast, with various success. The same class of fish being taken from the 'Sisters' up to Petaluma, nothing but sturgeons are found until we come to Vallejo, where there is a mackerel trap fishery.

"Down on the south shore we find two (2) Italian boats on the San Pablo flats, and two more at a favorite point to the north of Sheep Island, where there is another mackerel trap fishery.

"Two boats are employed at Sheep Island. They not only cast upon the beach, but generally fish at night under sail only, pulling round and towing the nets. The same fish, smelts, flounders, sardines, anchovies, and soles, are taken here.

"Two boats are frequently employed around Goat Island, two at Oakland Wharf, and two at Alameda Wharf. Large quantities are taken all along the Alameda Flats, some ten miles to the southward of Alameda, and on the west coast from Redwood Slough, all along until we come to Baybien where there is a favorite resort to repair and dry their nets and take out their boats. From there to Long Bridge boats are generally engaged, and I have in all cases, at each of these points, impressed upon the minds of these men the consequences that will attend any infringement on their part of the laws in regard to the fish interest, and especially of section number six. I have also, in most of these places, made arrangements with those who live near the beach to inform me of the first infringement, by taking the name or number of the boat.

"I am informed from a reliable source that a most wanton course of destruction is practiced by the settlers along the Sacramento and San Joaquin Rivers, which will, if not arrested, be attended with vital consequences, amounting to a total destruction in these waters of our salmon fisheries, which, to the State, are worth millions of dollars.

"Perch, flounders, shrimps, and herring spawn in December; smelt, in August."

From Captain Wakeman's report on the fisheries of some of the coast rivers we make the following extracts:

"In pursuance with your orders of the sixth instant, I have examined all the streams from Spanishtown to Pescadero, and herein submit my report in regard to their character as trout strams, their obstructions, and consequences arising therefrom:

"*Pilarcitos Creek*—Upon which Spanishtown is located, is a dirty red stream, of about two feet wide and one foot deep, and empties its waters upon the beach, about half a mile below the town. There is a steam flour mill here, but no sawmill, and judging from the thick, muddy water, nothing but catfish can live in it.

"*Gobethey Creek*—Two miles below Spanishtown, is a clear water trout stream, about two feet wide and a few inches deep, and empties its waters upon the beach. There are no mills upon this stream, and only natural obstructions, such as old decayed trees and their branches.

"*Purissima*, or Pure Water Stream—Is two miles below Gobethey Creek, and is a fine clear water trout stream, about four feet wide and a foot deep. Generally at this season (February) it has a volume of about ten feet in width and five feet in depth. It empties its waters upon the beach about half a mile below the Purissima House. Four miles up the stream is the sawmill belonging to Messrs. Boyden and Hatch. This mill has an overshot wheel, the water to run it being taken from the stream three-fourths of a mile above and carried in a sixteen-inch flume, at the head of which are four little dams, made by throwing a short log across and tamping it tight with a few bags of sawdust. This throws all the water into the flume and only half fills it, which shows that this stream is very small at the present time. A site for a new steam sawmill is being located two miles further up. The sawdust and blocks of the redwood are thrown into the stream, which turns the water to a dark red, and, in some places, to an inky black; in other places to a purple. This is poisonous, and kills the fish in half an hour after it is drank, according to the testimony of Messrs. Boyden and Hatch themselves. Cattle along this stream are walking skeletons. I saw several carcasses of dead animals lying along the bank, notwithstanding there is plenty of good grass. This shows conclusively the truth of all the reports made to me by many of the settlers along the stream. In places where the water runs fast it is quite palatable; but where it is still it becomes wholly unfit for use, and not only kills the fish, but is dangerous to the cattle. At some seasons of the year the settlers are obliged to sink holes or wells back from the stream, and even then the water is impregnated with an odor only to be derived from dead fish.

"*Lobetis Creek*—Is a clear water trout stream, two miles from Purissima, about three feet wide, and a foot deep. It empties its waters upon the beach, and has no mills—nothing but natural obstructions.

"*Tunis Creek*—Is a clear water trout stream, of about the same volume as Lobetis. It empties its waters upon the beach. Ten miles up this stream is Foment's steam sawmill, not running now, owing to a lawsuit pending and an injunction from the court; which last, it is to be hoped, may continue for all time, as the sawdust, so fatal to the fish and injurious to the farmer, is prevented thereby from being dumped into the stream.

"*San Gregoria*—Is a fine clear water trout stream, four miles from Tunis, and connects with the ocean about one mile below the San Gregoria House. At full sea, the salmon, of from fifteen to twenty pounds, and the silver salmon, from two to fifteen pounds, enter this stream during their spawning season, which is from

October to March, when they go out to sea again. These fish have been taken several miles up the stream during the rainy season, when, owing to the strong current, most of the sawdust had been washed out. Six miles up this stream is Templeton's steam sawmill, and a few miles further up, on a northern branch of this stream, is Gilbert sluice mill, and a few miles further up the same branch is L. P. Pharis' steam shingle mill. All these mills dump their sawdust and blocks into the stream, which so poisons the water that it has become an intolerable nuisance to all the settlers along the stream below, and will soon exterminate the trout.

"*Pompona Creek*—Is four miles from San Gregoria, and is a clear water trout stream of small volume emptying upon the beach. No mills; plenty of trout.

"*Pescadero stream*—Is three miles from Pompona Creek, and is a fine clear water trout stream, empties into the sea about two miles below the town, and connects, one mile from the beach, with the Butena River, which is also a fine clear water trout stream running to the southeast; is about twenty feet wide, and six feet deep. For six miles this makes a fine resort for the salmon and silver salmon from the sea which frequent these waters, with other lesser sea fish, for the purpose of spawning. From October to March a wagon load of these beautiful fish, weighing from two to thirty pounds, are taken daily and sold all along the road, as high up as Spanishtown, at seventy-five cents per pound. These fish are only taken during the spawning season, they being a deep water fish and go out to sea in March. Three miles up the Pescadero stream—which is about four feet wide and a foot deep, at present—is B. Hayward's steam sawmill, and three miles further up is Anderson's sawmill, run by a turbine wheel, having a well constructed dam, built of hewn logs, well secured right across the creek. The dam is twenty feet long and about ten feet high, built in eighteen hundred and sixty-two, and all the water from above passes at present through the sluiceway at the turbine wheel. As the water has never been half way up to the top of this dam since it was built, no fish have ever passed. A sluice box with stop waters in it for fish could be introduced through this dam near its base and outside the sluiceway for the wheel, this being the only place where the box could reach the water below, as all the rest of the bed of the stream is dry. Large quantities of sawdust and blocks are deposited in the stream below the dam; fish are found dead, their eyes eaten out by the strong poisonous acids in the water, and their bodies covered beneath the skin with disgusting blisters, like the smallpox, whilst the inside is as black as ink. The waters are rendered at times wholly unfit for use. Eight miles further up this stream is Wolf's steam sawmill, the lumber from which is hauled out to the eastward, whilst the sawdust is conveyed down the river, fatal to the fish and to the interests of everybody. There is but one sentiment existing among the settlers along the stream, and it is this: that they have arrived at a point where forbearance ceases to be a virtue, and have resolved to exhaust all legal measures, by their united efforts and similar means to protect their interests against the oppressive and persistent practice of the mill owners in dumping the sawdust into the streams, whereby the whole community below suffer, some hundreds and others thousands of dollars. The effects of the sawmills, during eighteen or twenty years, are scarcely perceptible in these almost impenetrable forests, and the united efforts of many mills for the next twenty years will be required before the woodman's axe will have wrung from the settlers of this nature's retreat in her solitude that beautiful prayer of 'Woodman, spare that tree.'

"I have communicated with many of the settlers along the banks of all these streams, and have the experience of the oldest settlers in this part of the country, and there can be but one conclusion in regard to the fish interest of these streams, and that is that the redwood sawdust poisons the water, and unless some other method is adopted to get rid of it, such as burning it or repairing roads with it, there will not be a breed of trout left in a few years. Where thousands were taken daily (thirteen hundred by one person), now scarcely a trout can be seen. If there are laws to protect them I can see no good reason for not enforcing them, and if this be done every man's table in this district will be abundantly supplied with trout—a healthy and cheap article of food—while large quantities will find their way, as a

luxury, to the rich man's table at a distance, so long as these streams shall flow 'from the mountain to the sea.'"

From the report of Mr. Haswell on the Truckee River and Lake Tahoe we make the following extracts. He says:

"Under your appointment, and in accordance with your instructions, I proceeded to that point on the Truckee River where it crosses our State line on its way to Pyramid Lake, in the State of Nevada. From thence I followed it up to its head, in Lake Tahoe. I also examined the California part of that lake; also Donner Lake and Donner Creek; but from want of sufficient time could only make inquiries about the Little Truckee and its sources, Webber Lake, and Lake Independence, though prior to my appointment I had visited them all for health and pleasure.

"During this official visit I heard and saw so much that requires the most stringent legislation in both states that I scarce know where to commence my report. But as a preliminary I suggest that carefully drawn laws, precisely similar in all respects, except the mere verbiage that is necessary to designate which State enacted them, be passed by each State, and that, if such a law is not unconstitutional, each act shall authorize the officers of the other State, armed with a proper writ from it, and any citizen of the other State who has seen the offense committed within its borders, to cross the line and make the necessary arrest, and without further ceremony take the prisoners back for trial. This seems arbitrary, but if it can be constitutionally made a law it will be found to be one of the greatest safeguards to the joint fisheries.

"Trout commence running up the Truckee, from Nevada, with the first sufficient rise of the river. The date of this, as also that of their return, is of course variable. They retire towards Pyramid Lake as the water recedes in the summer or fall.

"From the obstructions hitherto placed in this river and the various means used to entrap the fish before they reach the shallow, gravelly streams, together with the wholesale waste of them and the criminal distruction of their spawn, I believe that in a very few years the great lakes of both states will be entirely without brown trout, and certainly very few silver ones, unless the two state governments concur in some such law as that above suggested. But to return to my starting point—the Truckee at the boundary line.

"The first mill and dam (all the mills on this river are for sawing lumber) on the Truckee in California, is that of Pray & Bragg. At present it is little or no obstruction to the free run of the fish, and its owners have agreed that if it becomes one they will either open the dam itself or construct proper fish ways and ladders.

"The Boca Mill Company comes next. Mr. Doane, the resident partner, is about as enthusiastic on the subject of letting the trout have a clear passage to and fro between the lake and streams of this State and those of Nevada, as the members of your body themselves. At this dam there are two good fish ways—one on a plan recommended by yourselves, and the other built upon a design which Mr. Doane and the other members of the company think superior to it.

"The dam of the Marysville Company follows, then that of the Geissendoffer Mill Company, then in succession two others known as Proctor's. Neither one of these four is an impediment now. The mills have been removed, the sluiceways are open, and the dams themselves are all so dilapidated that the fish can pass through either of them.

"Succeeding the upper Proctor mill come five dams belonging to the Truckee Lumber Company. Four of these are mere dams to catch water when the river is low. They cause no hindrance whatever. The other one has an excellent and very efficient passageway, but a log got entangled in it and carried off a portion of the crossbars or resting places. The owners said that the necessary repairs should be made forthwith; and as they seem to take as much pride as the owners of the Boca Mill do in giving the trout fair play, I do not consider that it requires any further attention.

"I am sorry that I can not say the same of the next place—Rusch's Mill. Here is a so-called fish way which is of no possible use if it was constructed with a

view to allow the fish a passage up stream. If, on the contrary, it was built to be a most efficient trapping place, the intent was fully carried out. But the owner has promised that no further action need be taken, as he would as soon as possible either build a new passageway or else alter the present one to meet the requirements of the law.

"Except as above stated the fish have proper passageway in the Truckee to and fro from the State line to the debouchment of Lake Tahoe.

"According to your instructions, I returned from the lake to the line and crossed into Nevada to confer with the citizens of our sister State about opening the Truckee on their side so as to give the fish a perfect free way whenever they deemed proper to use it between the fresh waters of Tahoe and the brackish waters of Pyramid. The people there took the matter in hand. The owner of the only obstruction on the Nevada portion of the river was applied to, to either have fishways made, or in some manner give the fish a chance. He declined; but a little giant powder, used by some unknown hand, made the condition of things about that dam entirely favorable for the trout to indulge their migratory propensities.

"Donner Lake empties through a short creek, also called Donner, into the Truckee about fifteen miles below where that river leaves Tahoe. On Donner Creek I found a dam so constructed that no fish once leaving Donner Lake on its way down to the brackish waters of Lake Pyramid could ever get back again to breed. The consequence of this is that brown trout, which I believe always yearly go or at least start to go to the great Nevada lake, in Donner are extremely scarce, whilst the silver trout, which I think never, or if at all, but seldom, go down stream beyond the lake they first reached from their hatching grounds, are moderately plentiful.

"I may as well remark here that the above is my opinion as to the one kind coming down stream out of the lakes, and the other not doing so, at least not as a general natural instinct, though individual exceptions may occur. But it is contended that there is no distinction in species between the two kinds I designate as silver and brown trout—in fact, that they are the same thing—the apparent difference being merely local caused by the nature and color of the gravel in which they were hatched, and the peculiarities of the water in which they grew or live. Such may be the case, but I have examined a considerable number of both colors, and caught a good many trout in the Atlantic States in my younger days, and I consider that what I here call the brown trout is not the same as what was called the brook trout in that part of the country where I was born and brought up and caught fish. In every trout I have examined here the brown ones have a straight purplish line on each side of the body from almost the end of its nose to near the tail. This line is not on the silver ones, and on the brown ones I have never found any of the spots or dots usual on all trout below the purplish line. They have invariably been above it. If I remember correctly, the Eastern brook trout have nothing of the purplish line, but merely spots or dots. Not being an ichthyologist I merely call the attention of the Board to what I believe, from my own observation, and ask you and others who read this report to examine this question and another—are there any trout, either in this State or Nevada, except, perhaps, in the pure mountain streams further north? Whilst upon the Truckee and the lakes I heard several persons, who have the reputation of being ichthyologists, say that all the fish that we call trout, were in reality land-locked salmon, frequently called schoodic trout. But to return to the trap on Donner Creek. I could not find the owners of this dam, but learned that they were A. C. Toll and Brothers. I afterwards understood from Commissioner Redding that they had promised him that they would either remove the dam entirely or put in satisfactory ways and ladders.

"At the source of the Truckee, *i.e.*, Lake Tahoe, two persons have been and I believe that, to some extent, they are still in the habit of taking the fish by means of seines, nets, and traps, on the alleged pretense of catching them for their spawn to stock lakes, streams, and ponds. But the fact is they catch them at all times of the year, and sell immense quantities, without reference to either spawn or spawning season; and, although I did not see it, and can scarcely believe it, I have been informed by their neighbors of credibility that fish and spawn were dipped out by

the bucketful, and either consumed on the place or sold to others for hog feed. Of course, I notified these men of the provisions of the law, and forbid the further use of either seine, net, or trap at any season of the year, or for any purpose whatever. They promised obedience, and the residents of the vicinity said that they would take care that the law was complied with, and in the event of any violation the parties should be prosecuted with the greatest rigor to the utmost extent of the law.

"At the mouth of or a short distance up almost every small stream—the trout's breeding place—that empties either into the Truckee River, or Tahoe, Donner, or other lakes, fish traps are set in such a manner as to be actual murder to most of the fish, and complete destruction to their spawn. Taking advantage of the fish's instinct of procreation and continuance of its race, and of its other instinct, that that can only be done by going up stream to shallow water and a gravelly bottom, a trap is made, which is done as follows: A row of stakes is driven across the full width of the stream. These are not placed so close as to prevent the water coming down, yet are put so near that a trout can not get through to go up. Further down the stream another row is driven across. This is in every respect like the first, except that in one portion of it—about the center—an opening, say, a foot wide and two or three feet long, is left under water. The distance between the two rows of stakes is a matter of option, being from three or four feet to ten or twelve, depending somewhat upon the number of prisoners the owner expects to take, and how long, and for what purpose he intends to keep them. It will be seen that the fish can get in through the lower tier but not out through the upper one, yet might escape by returning; but this they will not do. Fish always return to spawn at the spawning place of their parents. Here they are, and reasoning, nature, instinct, or whatever else people may choose to term it, tells the fish that they are of no further use in the waters of this world unless they get up the stream to spawn and milt. So in this trap they remain, butting their heads against the upper stakes until they are either taken out or the growing ova and milt compels them to violate the laws of nature and die, when the fish and what should have been their descendants are dipped out and, as already said, given to the hogs. Trout are frequently thrown out with their noses absolutely butted off in the vain endeavor to force their way through the barricade.

"The Indians, and a good many whites, have another distinctive method of trapping trout, but it is nothing like so bad as the one described above. Even where there are good ladders and ways, a large number of fish try to run up the current pouring over the dam. After repeated efforts to run up on the face of the water against the impetus with which it is coming down, they become weak and exhausted, and can no longer keep upon the face of the stream and fall through it into the vacant space that is always found under the water that pours over a dam. In this space wicker or other baskets (the Indians use willow twigs) are fastened, and into these baskets the fish fall in great numbers, and of course can not escape.

"Two facts show conclusively that trout are fast disappearing from the lakes. One is, that very few, comparatively speaking, are caught now, even in the best seasons, with the hook and line. As a sample, I may tell of a Sacramento attorney who is noted as an expert in fishing—a gentleman who can nearly equal Izaak Walton for patience in wating for a nibble—who spent some four or five days this summer fishing on Donner. He was out by daylight, and did not return until dark, and the greatest number he caught in any one day was five. I may also state that every trout that he caught was silver—there was not a brown one in the whole number. The other fact is, that the so-called chub, the natural, as it would seem, food for the trout in the lakes, have of late years increased in such numbers as almost to be a nuisance.

"On the Truckee, about nine miles from Tahoe, Comer Brothers have a large establishment for rearing trout. I understand that it was started about three years ago, and that although it has been a success so far as to growing and distributing the fish, yet, in commercial parlance, it has been something very near a failure. I was told that Webber Lake was stocked from the Truckee several years ago, and that it is now well filled with good sized fish, though formerly it did not possess any

trout. If there is any means by which your Board can aid these pioneer California trout growers, I trust that you will do so.

"I believe that I have nothing to add, except to say that during the coming year and until people begin to understand the law, and the officers and courts enforce it, the entire time of at least one man will be required about Lake Tahoe, the Truckee, Little Truckee, and the lakes and streams that flow into them, for the protection of fish."

EXPENDITURES

Of the appropriation of five thousand dollars made by the Legislature to aid the Commissioners in importing new varieties of fish, and in preserving the native fish valuable for food, we have expended the following amounts:

1870		
Dec. 9th	Paid J. D. Farwell & Co. bill of sundries	$40.32
1871		
Feb. 9th	Paid expenses of E. Wakeman, examinations Bay of San Francisco	238.60
March 20th	Paid Bugbey & Sons, drawings of fish ladders	25.00
March 27th	Paid expenses of E. Wakeman, coast rivers	80.00
July 8th	Paid expenses of Seth Green and assistant in San Francisco	43.50
July 8th	Paid expenses of Seth Green and assistant in importing 15,000 young shad	348.30
July 8th	Paid fare of Green and assistant, return trip	186.50
Nov. 25th	Paid expenses of G. C. Haswell, examination of Lake Tahoe, Truckee River, and tributaries	175.00
	Total amount expended	$1,137.22

All of which is respectfully submitted.

B. B. Redding,
S. R. Throckmorton,
J. D. Farwell,
Commissioners.

CALIFORNIA FISH AND GAME

A publication devoted to the conservation of wild life and published quarterly by the California Division of Fish and Game.

The articles published in CALIFORNIA FISH AND GAME are not copyrighted and may be reproduced in other periodicals, provided due credit is given the California Division of Fish and Game. Editors of newspapers and periodicals are invited to make use of pertinent material.

All material for publication should be sent to Leo K. Wilson, Division of Fish and Game, 450 McAllister Street, San Francisco, California.

Vol. 19 January, 1933 No. 1

THE AUDIENCE

I mak' not moocha mon' today,
So few ees hear da tunes I play.
Long time bayfore da sun ees shine
I tak' dees street pian' of mine
An' pull eet out from ceety street
To countra lane, where cool an' sweet
Da morneeng breeza blow, an' where
All theengs ees beautifnl an' fair.
O here, I theenk, I gona find
Som' peopla so good-heart' an' kind
Dey weel be glad for hear me play
An' nota tal me "gona 'way!"
Lika mosta do dat I am meet
W'en I am play een ceety street.

I walk an' walk, but eet ees queer
I meet so few da peopla here;
Ees only wan or two, but steel
I look fora more. I clim' da heel
An' travel down da hotta road.
Da street pian' ees heavy load;
I am baygeen for feel da heat,
An' so, bimeby, I stop and seet
Een shady place bayside da way.
Oh, I am mad! I growl an' say:
"I mak' not moocha mon' today;
W'at for you com', O foola man!
Where no wan hear your street pian'?"

But, den, w'at s'pose ees happen me?
First theeng you know, ees leetla tree
Mak' funny noisa where eet stan's
So lika as eef eet clap eets han's
Den gentla feengers een da air
Dey com' an' pull me by da hair;
Ees som'theeng een dees sweeta breeze

Dat speak to me an' coax an' tease.
And den da sky, so wide, so blue,
Eet seem to smile an' coax me, too.
So all day long ees lika dat.
"Com', let us have da music. Play."

I play wan tune—yes, two, t'ree, four,
Like w'at I nevva do bayfore!
I stop. Da sky ery, "More!" An' den
I play dem evra van agen.
So, too, I leeft my voice and seeng.
Da breeze say, "More!" to evratheeng.
So all day long ees like dat.
O, 'mericana man! I gat
Som' curses an' som' food to eat,
W'en I am play een eety street,
But here da sky, da breeze, da tree,
Dey speak Eetalian to me!

I mak' not moocha mon' today,
So few ees hear da tunes I play,
But where ees reecher man dan I
Dat play to breeze, an' tree, an' sky?

—T. A. Daly.

E. LINGENFELDER, NEW ASSISTANT EXECUTIVE

The State Fish and Game Commission has appointed Edward Lingenfelder as assistant executive officer with headquarters in Los Angeles. Thus is given southern California an executive representation they have never enjoyed since the Division of Fish and Game was organized.

With the advent of J. Dale Gentry and Earl B. Gilmore as members of the Commission, they determined to give to the southern end of the State a representation in an executive way, because of its vast area, large population, varied sport and commerical fishing and amount of small and large game.

The main obstacle to this plan was to find the right man to fit into the picture. A man who possessed executive experience, together with an understanding of the needs for fish and game, and the ability to understand what commercial fishing means to this State, for along the southern coast are the greatest tuna canneries in the world, and the sardine canning plants are not much less important.

After considering many names submitted for this post, the Commissioners finally selected Lingenfelder.

Lingenfelder has demonstrated his executive ability. For years he was factory representative in Los Angeles for one of the largest tire manufacturing concerns in the country.

FIG. 19. Mr. E. Lingenfelder, assistant executive officer.

As an angler, he has ever been prominent in the propagation and protection of California's game fish, and has been active in the work of the Izaak Walton League. As a hunter, he has covered the high ranges of southern California in quest of game, and has hunted in the lowlands of the area for smaller birds and animals.

Lingenfelder's appointment means saving much time for the sportsmen and commercial fishermen. Many routine matters that in the past had to be presented to the Los Angeles office, then forwarded to the main office in the north for final action, will now be handled by the new assistant in the southern headquarters.

It is important that there be some one in charge in southern California clothed with definite authority to act on applications for permits and obtain information on all matters to guide the Commission in granting or denying such permits, as well as give out information relative to all sportsmen.

In Edward Lingenfelder, the Commission believes they have this man. Already he is receiving the fullest cooperation from all who have business with the Division of Fish and Game.

In Memoriam

A. J. STANLEY

We regret to report the death of Warden A. J. Stanley of Chico, who died from pneumonia on November 4, 1932, contracted, it is believed, by exposure during night patrol work in the upper Sacramento duck fields.

Warden Stanley entered the service of the Division in 1919, coming to us from the United States Forest Service. He was an experienced and capable worker and his fellow workers regret his untimely passing.

THE FIRST BIENNIAL REPORT

The first published report of the Commissioners of Fisheries of the State of California for the years of 1870–71 contains much valuable information to the workers in conservation at the present time. Not only is this information valuable from an historical point of view, but the facts presented therein are so necessary for a proper understanding of conditions as they exist today that it is thought desirable to make this information available to all those interested.

Long out of print, the only available copies at the present time so far as known are two—one privately owned and the other in the State Library at Sacramento. It is for that reason that CALIFORNIA FISH AND GAME has broken the usual precedent of maintaining the magazine as one of first impression and has sanctioned the reprinting of this first biennial report of the Board of Fish Commissioners (See pp. 41–56).

DEER HEAD EXHIBIT

At the annual State Fair held in Sacramento, September 3 to 10, 1932, the Division of Fish and Game sponsored the first deer head competition.

This competition took the form of an exhibit of trophies killed by sportsmen in California and these heads were entered for prizes offered by interested sportsmen. Records of big game are not only interesting to the sportsmen who succeed in taking them in the field, but are always interesting to all people interested in the out-of-doors.

At the first exhibit, and it is planned that this shall be an annual event, fifty-five excellent deer heads were exhibited. The majority of the heads in this first exhibit came from the counties of Modoc and El Dorado.

His Excellency James Rolph, Jr., appointed a committee composed of Sam Hubbard of Berkeley, Gus Nordquist of Oakland, F. E. Farnsworth of Santa Ana, A. Muelheisen of San Diego, Tom Mont-

gomery of Niland, Hardin Barry of Susanville and Sam Wells of Eureka to serve on the Committee of Awards.

The judging took place on Saturday, September 10th, the last day of the fair, and because of the enforced absence of some of the judges, Monte Newbert of Sacramento, W. C. Jacobsen and W. B. Ryder were selected to serve with Mr. Farnsworth and Mr. Nordquist.

FIG. 20. A. J. Stanley Display, Sacramento State Fair, September 3 to 10, 1932.

The awards were made as follows:

Mule Deer Class: First prize, George Webster, Lincoln, who displayed a head killed in the county of Modoc with 11 points on the right side and 10 on the left, spread of 37⅞ inches.

Second prize, R. N. Wilson, Weed, Siskiyou County, who exhibited a buck head with 6 points on the right side and 7 on the left, 37½-inch spread.

Third prize, V. B. Caid of Butte City, Glenn County, who displayed one of the most remarkable heads in the exhibit. This deer was killed near Adin, Modoc County, with 17 points on the right side and 11 points on the left, having a 34¾-inch spread. The large number of points made this a most spectacular head and it was the cause of much comment among individuals seeing it for the first time.

Black Tail Class: First prize, D. L. Woods of Sacramento, who showed a buck with 5 points on the right side and 4 on the left, 29¾-inch spread.

Second prize, Mr. Baranek of Folsom, who exhibited a 3-pointer with a 27¼-inch spread.

One prize for Best Conformity: The most beautiful buck displayed was a 4-point mule deer, killed by Lambert Almquist of Sacramento. This was a beautiful trophy with high beams but not many points.

Largest Deer Head Submitted by a Sportswoman: First Prize, Mrs. Maude Sorenson, who exhibited a 4-point mule deer killed in Modoc County.

So successful was this exhibition and so great the interest created among sportsmen that it is certain this event will be a tremendous success in future years.

LIFE HISTORY NOTES

RATTLESNAKE AND PLUMED QUAIL

One day last summer while hiking down Holcomb Creek, back of Big Bear Lake, San Bernardino Mountains, California, I came upon a rattlesnake that had a one-third grown plumed quail, *Ortyx picta plumifera*, in its mouth. The snake was a comparatively small one, less than three feet long and rather slender, but had nearly half swallowed the quail. The bird was dead. As I attempted with a stick to keep the snake from crawling into some bushes with its victim, for I hoped to get some pictures, the snake disgorged the bird and came for me. It seemed to be especially vicious and put up quite a battle until I killed it, which in my experience is not usual, as these snakes generally attempt to escape from humans as fast as possible. Plumed quail are fairly common in this canyon and rattlesnakes especially so. This gives us an excellent illustration as to some of the always present dangers that our smaller game birds have to contend with. I believe that quail are shot very little in this district and I know that they just about hold their usual numbers from year to year, with slight fluctuations in abundance from season to season.—WRIGHT M. PIERCE, Claremont, California.

PROTECTION FOR OUR HAWKS

For the past few years I have put in all my spare time studying the bird life of California, particularly relative to the Santa Clara and Monterey counties area.

Here we have a dozen species of hawks and falcons that are more or less common and all are given a black reputation by most people. Regardless of the fact that all but three or four of these hawks are given year around protection by the State, it seems to be the usual custom of hunters to shoot all hawks on sight. Farmers lose some poultry from a wandering sharp-shinned or Cooper hawk and immediately declare war on every bird bearing the name hawk, not knowing the loss they are causing themselves.

After studying these birds in the field—summer and winter, cultivated and wild areas—in a territory where conditions are an example of those found anywhere in the State, my reaction is that aside from three species, the balance of the Raptors are decidedly beneficial birds and deserve all the protection that can be given them.

The sharp-shinned hawk, Cooper hawk and duck hawk are admittedly out and out killers, taking song birds, game birds, poultry or anything that comes their way in the line of meat. These hawks must be controlled and as an economic and game conservation measure should be shot whenever an opportunity offers.

The balance of the hawks and falcons are of great economic value, to the naturalist from the standpoint of the color and beauty they lend

to the surrounding country; to the land owner for the help they give in rodent and insect control.

The sparrow hawk and pigeon hawk are both very much misnamed, as their diet consists almost altogether of mice, crickets, grasshoppers and other harmful insects. They are very highly colored, inoffensive and tame, hunting their food near inhabited buildings when not shot at. They do no harm and a lot of good and should have credit for it.

When one sees a Cooper hawk or duck hawk dive on a flock of birds and kill ruthlessly, they should not be confused with the red-bellied hawk, marsh hawk or prairie falcon, which to the untrained observer may seem of somewhat the same size and appearance, but with altogether different habits. The red-bellied hawk inhabits the wooded areas while the marsh hawk and prairie falcon are found in the open country, all hunting for rabbits, squirrels, rodents and insects, a diet one hundred per cent beneficial to the landowner. The only one of these three hawks whose reputation is doubtful is the red-bellied hawk, who will take a bird now and then, but this species has been reduced to so few birds and their preference for small mammals when available make the damage done by them very slight.

The large buzzard hawks, namely, the red-tailed, Swainson's, American rough-legged and Ferruginous rough-legged are the most persecuted and the least deserving of it of all the Raptores. These hawks are large, slow to move and very confiding, making them easy prey to the men that shoot them. They are usually found on some high favorite lookout from which they sail out in search of squirrels, small rodents and insects, which form their entire diet. These hawks work day after day for the landowner and are beneficial to such an extent that the protection he affords them comes back to him many times over in the increased crops due to rodent control. The farmer should make it plain to the hunters who enjoy the privilege of hunting over his property that he will not permit the killing of these birds.

When a hunter sees a medium sized hawk darting through the trees and thick brush, it is pretty safe to shoot and know you are doing your share to control the killer type of hawk, but the hawks, large and small, found perched on some lookout in the open and easy to approach are the ones to be left alone and encouraged to remain where they will do the most good.

Let us list a few of the hazards these birds have to contend with. The poisoning of squirrels, their main food supply, and death from eating the poisoned squirrels that die on top; the hunter shooting all hawks; the constant reclamation of land and taking away their natural cover and food supply; adverse weather conditions; robbing of nests; the young boy with his new .22 rifle and many others. And the birds that survive all these come back and ask only to be left in peace to eat rodents and insects that are destroying the crops.

Let every sportsman—and we hope that every man carrying a gun in the field is one—look this problem squarely in the face and I know we will have a lot more men out seeing the beneficial hawks get a break.

The American people are taking the question of bird conservation too lightly. Years ago everyone thought our game would last forever, would never be killed off. Now the game farms must raise and turn loose pen-raised birds to maintain a breeding stock. Every year more

species are nearing extinction and being put on the protected list and given the most rigid protection. Educational programs are being introduced into the schools. Every effort is being put forth to assure future generations of the same amount, if not more, of bird life than we have now.

It's a big job and the responsibility of the work rests on the shoulders of a few. Every citizen is reaping the benefit and should do his bit to help. Are you helping?—H. R. ESCHENBURG, Gilroy, California.

UNSEASONAL BREEDING OF DEER

J. W. Jaques, a supervisory employee of the Berkeley post office, related the following incident, which I thought might be of interest:

About midnight, August 18, 1932, on the Redwood Highway between Cummings and Latonville, Mr. Jaques was obliged to slow down almost to a stop to prevent injury to a small fawn. He described the fawn as being very small, probably only two days old, and very wobbly as it walked across the road. His car lights "shined" the eyes of what he believes was the mother doe, in the brush at the side of the road. The fawn moved in that direction.

Can anyone account for this unseasonal breeding among deer?—GEORGE TONKIN, Berkeley, California.

DIVISION ACTIVITIES

BUREAU OF FINANCE

Economic conditions that have caused a falling off in all lines of business had an effect on the income of the Division of Fish and Game. Many people who have gone into the field and mountains and on the streams in past years felt they could not afford the expense this year, and so bought no hunting and fishing licenses. As a result there will be a decrease in income for 1933, over 1932, of approximately $150,000. The sale of deer tags fell off this year approximately 30,000. Hunting showed the greatest decrease. Angling license sales maintained a good average.

Efforts will be made, after the first of the year, to arrive at some mutual understanding with county clerks to have the distribution of hunting and fishing direct from the three branches of the Division. This will enable a quicker check of the income each year.

Fines fell off, magistrates being reluctant to assess high cash penalties on offenders.

Income from sardine canners has been kept up this season by the issuing of special permits for larger tonnage of sardines for reduction purposes.

Despite the depression, accounts have been paid in promptly, and but few are delinquent.

BUREAU OF FISH CULTURE

The annual trout planting for the 1933 season was practically completed in October. Hatchery activities were confined for a period of some weeks to preparing these plants for the reception of eggs. Spawn taking was commenced during the month and continued through December. In November over 11,000,000 eggs were taken, making the total for the season 13,571,168.

The Shasta Hatchery planted more fingerlings this year than at any time in its history, the output being close to the twelve million mark.

It has been found that greylings are doing well in Yosemite waters, and that those planted in the high lakes are reproducing well.

All trout activities in southern California have been centered on the Forest Home Hatchery taken over by the Division of Fish and Game this year. All aged fish at the plant have been planted in southern trout waters with the exception of a sufficient supply of spawners.

At Friant the small mouth black bass are doing well, and during December the first planting of young fish was made. Fresno sportsmen's associations will assist in this work. Plenty of food fish have been developed and more adult bass are being added to the ponds.

The salmon egg taking was a great success last year. At Klamathon 20,000 salmon were held and 4,000,000 eggs taken in five days. To date there have been obtained from the annual run of salmon over four and one-half million eggs.

The last of the five-inch salmon fingerlings from the Fall Creek Hatchery were released to go down the Klamath River.

Meetings of Division hatchery employees at Shasta and Fresno featured the activities of the bureau during the past quarter. These meetings were of especial benefit as Dr. J. O. Snyder and other fish culture experts addressed the workers and gave them an outline of the trout program of the Commission. The hatchery personnel also presented their problems and Leo K. Wilson, in charge of the Bureau of Education and Research, entertained the two meetings with moving pictures of Division activities.

BUREAU OF FISH RESCUE

The work of this bureau for the last three months was not as arduous as it was a year ago. Water conditions were somewhat improved. However, the bureau saved for the streams and lakes of the State nearly half a million valuable sport fish. These fish were taken from areas where the water was low or where the fish were impounded and unable to get free. They were taken to waters where restocking was desirable.

In the list of fish rescued were over 15,000 striped bass, and over 100 small mouth black bass. October was the most active month when over two hundred thousand fish were rescued.

BUREAU OF PATROL

This department lost one of its valued deputies during November, Warden A. J. Stanley passing away after an attack of pneumonia. He

was very active in enforcing the duck laws, and during the first few days of the present season was out long hours, late at night and early in the morning. This exposure is thought to have had its effect on him. Deputy Stanley has always been a conscientious officer and a hard worker. He was popular in those districts he operated in and had the respect of all law abiding citizens.

The opening of the duck season for a two-month period brought but few complaints, the great majority of hunters adhering to the Federal regulations as well as rules set down by the Division of Fish and Game.

Some trouble was had in the San Diego area with hunters who insisted on killing ducks protected by the Federal game laws.

The first instance in many years of a mountain sheep being killed and the offending shooter being apprehended occurred near Independence, Inyo County. Warden C. J. Walters of Independence said the sheep had come down to a 3700-foot elevation, got mixed up in some fenced property, became confused and could not find its way out. A rancher seeing the animal, which was a ram about three years old, shot it. He was arrested and fined $100.

Warden F. J. McDermott succeeded in uncovering and arresting a game bootlegger of Williams, together with three of his assistants. A large quantity of quail, ducks, geese and venison were purchased by the warden, who had some of it shipped to Palo Alto. The proprietor pleaded guilty and was sent to the Santa Clara County jail for 180 days while his employees were given 90 days each in the Colusa County jail.

Fines fell off for the three months period, though arrests kept up to about the average.

Spotlight hunting caused 17 arrests, hunting from automobiles caused 8 more, having no hunting licenses brought in 72 offenders; killing does and illegal bucks was responsible for many more. Having deer meat in possession at the wrong time caused a lot of activity by the deputies.

The *Bluefin* was brought to San Francisco for rudder repairs and painting, during October, as well as to have a wireless installed.

The *Albacore* spent considerable time scouting the seas off the Monterey coast for tuna.

The *Quinnat* has been assisting in tagging striped bass in the San Francisco Bay area.

BUREAU OF VOLUNTEER WARDENS

The work of this bureau respecting quail activities is beginning to be felt. Reports indicate quail on the many sanctuaries have increased in numbers. The increase runs from 25 to 100 per cent, some instances being noted where the increase was even greater. New areas are being signed up and proper steps taken to protect and improve conditions for this great upland bird.

So well do quail like these refuges that they raise more families per bird per year. Reports disclose that on many sanctuaries a pair of quail will raise two broods and sometimes three broods a season.

Juvenile offenders, who have caused some difficulties with the law enforcement branch of the Division, are being handled in a different way than formerly. Instead of haling the youths before a magistrate

they are now taken to their parents and the latter are told what their sons have been doing in violating the game laws. It is pleasing to see how the parents are cooperating with the Commission in impressing these boys of their wrongdoings.

BUREAU OF HYDRAULICS

One of the most important fish and game law decisions from a higher court was handed down by the Third Appellate Court during the latter part of last year. This decision, an appeal from a superior court judgment, was the case of the Division of Fish and Game against the Glenn-Colusa Irrigation District. The action was originally instituted to force the district to install fish screens in its canals. The district refused to do this and the matter was taken to court. The Division won in the superior court and when the case was taken to the court of appeal the Division was upheld, and the district ordered to place proper fish screens. It is likely an appeal may be taken to the Supreme Court.

The city of Los Angeles objected to being forced to put in fish screens in two of the canals of their Owens River water supply. However, after hearings before John Spencer, head of the Bureau of Hydraulics, and one before the Commissioners, the attorneys for the city of Los Angeles announced the waterways under controversy would be abandoned and no water sent through them. They were advised that if they used the canals for carrying water they would have to put in the screens, and this was agreed.

The Benbows, after considerable trouble, and in which it was necessary to take the matter to the superior court, have finally installed proper fish ladders at their dam below the Benbow hotel, on the Eel River.

The death of some 5000 fish at two areas, ten miles apart, on Clear Lake called for investigation by this bureau. However, it was determined that the deaths were not caused by man, but to some chemical reaction in the water which destroyed the oxygen. It was learned there was a similar occurrence some twenty-five years ago on the lake.

BUREAU OF GAME REFUGES

The closing of the 1933 deer season brought to light some interesting features. First the number of deer reported legally killed fell off some 7500 over the 1932 season. It was the lightest kill of bucks since the deer tag law went into effect in 1927. Second, the number of deer tags sold was some 30,000 less than last season. The percentage of deer killed in proportion to the number of tags issued in former years was about the same this year. The individual record of one deer killed for some six tags issued was also observed in the figures for the year.

These facts indicate there is no decrease in the deer population in California. Further figures support this statement. The same percentage of two-point, three-point and four-point bucks maintained in previous seasons prevailed this year. Of the 18,380 deer killed during the present year, 46 per cent were two-pointers, 29 per cent three-pointers and 24½ per cent were four-pointers.

Some large bucks were reported on the returned deer tags. One with 20 points on the right side and 14 on the left side was brought down in Madera County. In Ventura County a 11-point right side and 14-point left side deer was killed.

Over 2200 hunters got two deer against 2900 last season.

The duck season opened on November 1 for a two-month period. The opening week was good for the hunters, but with warm weather prevailing in the northern haunts of water fowl, the birds were late in migrating south, and the last weeks of November saw but few limits. With storms in the north the birds began to take their southern flights, and after the end of November shooting improved. Geese were just beginning to flock in during the last of November.

All the northern State water fowl refuges are attracting thousands of ducks and geese, these birds readily finding safe havens with plenty of food.

Discovery of many dead ducks on Joice Island Refuge and San Pablo area caused a fear that the duck disease had reappeared. Analysis, however, revealed they had died from lead poisoning, caused by the birds scooping up shot in the shallow waters.

Most of the elks designed for the Buttonwillow Elk Refuge have been rounded up and inclosed in the 1000-acre tract. Some difficulty was experienced in getting the animals into the enclosure, they having been frightened by ranchers who scared them off their cultivated lands.

The kill of mountain lions for the past year went over the 300 mark. With 19 bounties paid in November the number for 1932 was 307, ten more than for all last year.

While fire swept over a large area of Refuge 3D in Ventura County, the damage to game was not as serious as at first reported. A survey of the loss of game was made by Donald McLean, who reported that large numbers of birds and animals returned to the burned-over areas as soon as the fire was out.

BUREAU OF GAME FARMS

As the last quarter of the year arrived, activities at the Yountville and Chino Game Farms subsided. September witnessed the heaviest planting of game birds—pheasants, quail, turkeys and partridges—of any previous month, and with these birds distributed in suitable areas this phase of the year's work was about completed.

Work of preparing pens for the brood stock, held over to provide eggs for incubation, and to fill the heavy demand that is being made by sportsmen's associations for pheasants and quail, has gone forward during October and November.

With enlarged facilities, the installation of new electric brooders and incubators, the game farms this year were able to produce more birds than any preceding year. The stock released were all healthy, free from vermin and in splendid condition to take up their homes under natural surroundings.

Many large areas have been obtained for refuges, one in Monterey County of some 21,000 acres suitable for quail, turkeys and pheasants. Two others in Napa County totalling nearly 22,000 acres. Stock birds will be placed on these refuges and allowed, under absolute protection, to increase their numbers.

Hundreds of visitors have called at the two game farms and many were astonished at the wonderful work being done, and the modern equipment used to produce upland game birds to be liberated throughout the State.

BUREAU OF COMMERCIAL FISHERIES

Most all the sardine plants in the Monterey-San Francisco area were busy this quarter. However, they were mostly engaged in reducing sardines to edible oils and flour, under the special permits issued by the Commission. The ratio of canning as compared to reduction this year is about opposite to last year. For the four months to date of 1931 out of over 53,000 tons of fish received nearly 44,000 tons were used for canning and some 10,000 tons for other purposes. This year, of 56,277 tons of sardines received at the canneries, about 10,000 tons were used for canning and nearly 46,000 tons for reduction purposes. In the San Pedro-San Diego area more sardines are being canned than in the north.

The carry over of sardines from last season has about been disposed of and the canners are expected to start building up a stock for the coming year.

In Monterey Bay sardines have been scarce, the small boats having but little success in getting loads. The large boats that can go out of the bay had no difficulty in landing full cargoes.

The canners are paying in Monterey $4.10 to the fishermen for sardines. This figure was fixed after a special meeting of the Fish and Game Commission with the Monterey canning operators and fishermen. In southern California the price is $4 per ton.

Sardines are expected to come into Monterey Bay during December, when there will be much activity among small boat operators.

During the quarter, permits for reduction purposes totaled 67,500. It is estimated over 80,000 tons of sardines will be used this season for all purposes.

Monterey was the center of a novel experiment and one which resulted in considerable success. The Hovden Food Products Company offered $100 a ton for tuna delivered at the Monterey wharves. The Commission's boat, the *Albacore*, went on a scouting expedition in the Monterey area, and on the report that tuna were found, some 200 boats from San Pedro and San Francisco went to sea, sighted a school of tuna and before the run was over landed 276 tons, all but thirty tons being canned in Monterey. Those packed there made a pack of 12,162 cases.

So successful was the experiment that other canners have announced they will put in machinery for tuna canning and be ready when the "chicken of the sea" makes a run to the north next summer. The tuna pack at Monterey gave employment to 200 people for a month.

Tariff regulations on tuna, made effective this season as an emergency measure, are estimated to mean more than one million dollars to the State from the output of the San Pedro plants and about the same in the San Diego district.

Tuna landings at San Pedro dropped off 50 per cent. San Diego kept up to normal catch.

Oysters are showing great progress in the Elkhorn Slough and Drake's Bay as well as lower Humboldt Bay. Experiments carried on at Elkhorn show that eastern oysters are thriving and growing nearly as fast as the Japanese oysters. In Drake's Bay the oysters do not develop as rapidly as in Elkhorn.

From Elkhorn Slough there was shipped last year 6500 gallons of shucked Japanese oysters. As many gallons will be produced this season.

At Pismo Beach a survey shows there is a great reduction in clams, and that the size limit law must be rigidly enforced if a desirable supply is to be maintained.

This bureau has been, with the assistance of sportsmen's organizations, tagging striped bass in the San Francisco Bay areas. Special tags have been provided on which are numbers and instructions to fishermen catching a bass thus tagged. From the first lot which were marked returns were received. One fish tagged was found many miles from the point of tagging. It is the aim of the bureau to ascertain the range of migration of the stripers.

Henry O'Malley, head of the U. S. Bureau of Commercial Fisheries, with J. R. Russell and Joseph Craig, of the Seattle offices of the U. S. Bureau, called at our San Francisco headquarters.

BUREAU OF EDUCATION AND RESEARCH

The division was fortunate in arranging with Radio Station KFRC to tie up a program covering the work of the Division of Fish and Game. These programs, under the supervision of Al Pearce, director of the Happy-Go-Lucky Hour are continuing to progress and are reaching thousands of people who have never been told of the work of the division.

Through the efforts of this bureau, the biennial report covering the activities in detail of the division for the period July 1, 1930, to June 30, 1932, has been issued. There is no charge for this bulletin, and we shall be glad to send it to interested persons upon request.

REPORTS

GAME CASES

July, August, September, 1932

	Number arrests	Fines imposed	Jail sentences (days)
Deer; closed season	42	$1,663 00	30
Deer; killing does, fawns, spike buck	30	1,575 00	205
Deer Tag License Act; violations of	26	630 00	----------
Doves; closed season; over limit	14	235 00	27
Ducks; mudhens; closed season	9	295 00	----------
Gull; killing of	1	----------	----------
Hunting License Act; violations of	61	920 00	29
Hunting in refuge	20	490 00	50
Night hunting; spotlight hunting	34	1,450 00	251
Nets; bird	1	25 00	----------
Pheasants; killing of	7	175 00	15
Quail; closed season	8	730 00	----------
Rabbits; closed season	5	120 00	5
Shooting from automobile	11	165 00	----------
Trapping song birds	2	----------	25
Trespassing on enclosed ground	2	51 00	----------
Tree squirrels; killing of	3	----------	15
Shorebirds; killing of	1	10 00	----------
Bear; closed season	1	10 00	----------
Totals	278	$8,544 00	652

FISH CASES

July, August, September, 1932

	Number arrests	Fines imposed	Jail sentences (days)
Abalones; small	10	$855 00	10
Angling License Act; violations of	64	808 00	261
Barracuda; small	3	10 00	----------
Bass—			
Striped; over limit	48	805 00	55
Black; over limit	5	70 00	----------
White sea; small	1	350 00	----------
Clams; small; over limit	37	644 00	238
Crabs; small	7	160 00	----------
Commercial Fishing License Act; violations of	30	135 00	28½
Lobsters; closed season	4	50 00	45
Night fishing	4	200 00	----------
Salmon; untagged in possession	2	150 00	75
Seines; nets; illegal	12	75 00	300
Trout; over limit; netting of	26	325 00	67
Tuna, yellowfin; small	16	425 00	----------
Taking marine life in Hopkins Marine Life Refuge	1	10 00	----------
Dumping sardines	1	----------	----------
Illegal fishing apparatus; use of	5	185 00	----------
Fishing from fish ladder	1	25 00	----------
Totals	277	$5,282 00	1,079½

SEIZURES OF FISH AND GAME

July, August, September, 1932

Fish:	
Albacore, pounds	50
Abalones	1,520
Barracuda, pounds	10
Bass—	
Black	108
Striped	208
Striped, pounds	70
White sea, pounds	892
Clams	1,180
Crabs	110
Catfish	11
Herring, pounds	50
Halibut	27
Lobsters, pounds	301
Perch, sunfish, crappie	113
Salmon, pounds	7,870
Trout	398
Tuna—	
Bluefin, pounds	150
Yellowfin, pounds	91,938
Skipjack, pounds	39,532
Traps, fish	27
Miscellaneous fish, pounds	52
Game:	
Deer	36
Deer meat, pounds	543
Doves	133
Ducks	28
Seagull	1
Pheasant	2
Quail	56
Rabbit	6
Squirrel, tree	1
Shorebirds	2

STATEMENT OF INCOME

For the Period July 1, 1931, to September 30, 1932, of the Eighty-fourth Fiscal Year

Departmental income	Detail	Total
License sales		
Angling licenses, 1931	$927 00	
Angling licenses, 1932	92,394 00	
Commercial hunting club licenses, 1932-33	200 00	
Commercial hunting club operators licenses, 1932-33	60 00	
Deer tags, 1932	18,991 00	
Fish breeders' licenses, 1932	20 00	
Fish importers' licenses, 1932	5 00	
Game breeders' licenses, 1932	67 50	
Hunting licenses, 1931	168 00	
Hunting licenses, 1932-33	79,411 00	
Kelp licenses, 1932	30 00	
Market fishermen's licenses, 1932-33	12,940 00	
Trapping licenses, 1932-33	39 00	
Wholesale fish packers' and shell fish dealers' licenses, 1932-33	590 00	
Total license sales		$205,842 50
Other income:		
Contributions from importers	165 00	
Court fines	9,021 31	
Fish packers' tax	14,361 37	
Fish tag sales	781 68	
Game tag sales	48 60	
Interest on bank balances	1,555 05	
Kelp tax	3 02	
Total other income		25,936 03
Total departmental income		$231,778 53
Income for the State University Fund:		
Kelp tax		$1 50

STATEMENT OF EXPENDITURES

For the Period July 1, 1932, to September 30, 1932, of the Eighty-fourth Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Bureau administration:					
Executive	$2,250 00				$2,250 00
Clerical and office	5,402 41	$194 00	$267 76		5,864 17
Printing		56 87			56 87
Automobiles		27 00	53 06		80 06
Traveling			515 31		515 31
Postage			723 27		723 27
Telephone and telegraph			652 77		652 77
Freight, cartage and express			856 26		856 26
Rent			3,052 22		3,952 22
Accident and death claims			451 70		451 70
Accounting, pro rata	1,125 00				1,125 00
Legal	900 00		7 50	$63 10	970 60
Premiums on bonds			83 52		83 52
Total bureau administration	$9,677 41	$278 77	$7,563 37	$63 10	$17,582 65
Bureau education and research:					
Chief and assistants	$975 00				$975 00
Clerical and office	480 00	$10 84	$41 92		532 76
Traveling			881 32		881 32
Photographer			28 14	$119 43	147 57
Librarian	510 00		15 07	3 09	528 16
Research	1,650 00	16 56			1,666 56
Publicity	900 00		11 12		911 12
Lecturer	525 00				525 00
Total bureau education and research	$5,040 00	$27 40	$977 57	$122 52	$6,167 49
ureau patrol and law enforcement:					
Chief and assistants	$2,775 00				$2,775 00
Clerical and office	795 00	$14 60			809 60
Automobiles		1,187 01	$1,634 44	$1,549 32	4,370 77
Traveling			23,930 05		23,930 05
Postage			157 68		157 68
Telephone and telegraph			341 34		341 34
Freight, cartage and express			4 70		4 70
Rent			63 05		63 05
Captains and deputies	50,415 00	48 16	61 56		50,524 72
Launches		231 65	813 84		1,045 49
Fish planting	1,155 00	119 43	133 00	100 00	1,507 43
Premiums on bonds			70 00		70 00
Statistical			168 00		168 00
Temporary help	60 00				60 00
Cooks	375 00				375 00
Commercial fisheries patrol—					
Chief and assistants	690 00				690 00
Captains and wardens	4,140 00	80	13 15		4,153 95
Launches	2,820 00	689 05	43 60	10 91	3,563 56
Fish cannery inspectors—					
Seasonal	1,129 80				1,129 80
Travel			2,047 18		2,047 18
Rent			180 00		180 00
Automobiles			4 48		4 48
Temporary help	253 34				253 34
Total bureau patrol and law enforcement	$64,608 14	$2,290 70	$29,666 25	$1,660 23	$98,225 32
ureau commercial fisheries:					
Chief and assistants	$3,405 00				$3,405 00
Clerical and office	2,400 00	$4 09	$34 25		2,438 34
Automobiles		24 46	22 65		47 11
Traveling			1,834 82		1,834 82
Postage			75		75
Telephone and telegraph			119 87		119 87
Freight, cartage and express			155 44		155 44
Rent			154 26		154 26
Heat, light and power			58 41		58 41
Research	1,233 00	1 68			1,234 68
Launches		4 46			4 46
Laboratory	6,355 06	76 21	181 62	$130 47	6,743 36
Statistics		225 75	451 96	30 00	707 71
Fish cannery research			1,250 00		1,250 00
Total bureau commercial fisheries	$13,393 06	$336 65	$4,264 03	$160 47	$18,154 21

STATEMENT OF EXPENDITURES

For the Period July 1, 1932, to September 30, 1932, of the Eighty-fourth Fiscal Year—Continued

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Bureau fish culture:					
Chief and assistants	$2,700 00				$2,700 00
Clerical and office	1,020 00	$1 95	$20 03		1,041 98
Automobiles		1,137 53	595 10	$1,198 58	2,931 21
Traveling			3,551 78		3,551 78
Postage			42 48		42 48
Telephone and telegraph			107 57		107 57
Freight, cartage and express			75 64		75 64
Rent			324 00		324 00
Heat, light and power			291 31		291 31
Hatcheries	30,035 00	20,340 35	1,136 08	324 17	51,835 60
Special field investigations	1,740 00		50		1,740 50
Fish cars	885 00	169 91	331 12		1,386 03
Blue printing			7 47		7 47
Cooperative research	$25 00	$7 01	826 70	682 22	2,421 53
Temporary help	770 00				770 00
Fish hatchery assistant—Seasonal	9,012 83				9,012 83
Total bureau fish culture	$47,986 83	$21,737 35	$7,309 78	$2,204 97	$79,328 93
Bureau hydraulics:					
Chief and assistants	$2,085 00				$2,085 00
Clerical and office		$11 92	$15 52	$39 60	67 04
Automobiles		52 05	17 84		69 89
Traveling			245 62		245 62
Total bureau hydraulics	$2,085 00	$63 97	$278 98	$39 60	$2,467 55
Bureau game propagation:					
Superintendents	$825 00				$825 00
Automobiles		$198 00	$109 21		307 21
Traveling			1,079 48		1,079 48
Postage			12 50		12 50
Telephone and telegraph			45 04		45 04
Freight, cartage and express			4 90		4 90
Heat, light and power			438 38		438 38
Rent			15 00		15 00
Maintenance	3,462 00	1,777 06	110 48	$28 00	5,377 54
Temporary help	975 00				975 00
Quail trapping and expansion of quail program	1,833 00				1,833 00
Total bureau game propagation	$7,095 00	$1,975 06	$1,814 99	$28 00	$10,913 05
Bureau fish rescue:					
Chief and assistants	$1,200 00	$31 00			$1,231 00
Traveling			$546 09		546 09
Rent			30 00		30 00
Temporary help	44 00				44 00
Total bureau fish rescue	$1,244 00	$31 00	$576 09		$1,851 09
Bureau game refuge:					
Chief and assistants	$2,124 99				$2,124 99
Clerical and office	480 00				480 00
Automobiles		$74 51	$26 40		101 01
Traveling			995 86		995 86
Telephone and telegraph			00		90
Lion hunters and trappers	1,845 00				1,845 00
Refuge posting	180 00				180 00
Predatory animal control			1,710 00		1,710 00
Temporary help—seasonal	1,362 71				1,362 71
Refuge maintenance	1,665 00	546 66	1,040 38		3,252 04
Predatory animal hunters and trappers—Seasonal	2,375 00				2,375 00
Total bureau game refuge	$10,032 70	$621 27	$3,773 54		$14,427 51

STATEMENT OF EXPENDITURES

For the Period July 1, 1932, to September 30, 1932, of the Eighty-fourth Fiscal Year—Continued

Function	Property and Equipment	Total
Construction and improvements:		
General repairs, improvements and construction of cottage at the Brookdale Hatchery	$311 25	
Lake Elinor egg collecting station	231 12	
Tank and egg collecting station at Huntington Lake	77 74	
Klamathon Station—station house and dry room project	305 82	
Klamathon Station—warehouse project	156 00	
Repairs and improvements at Mt. Shasta Hatchery	09 40	
Total construction, improvements and equipment		$1,181 33
License commissions		8,260 11
Purchase of game refuges		33,405 05
State Fair and other exhibits		1,224 47
Prior year expense—eighty-third fiscal year		1,830 50
Prior year expense—eighty-second fiscal year		5 00
Grand total proprietary group		$295,025 16

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF JULY, AUGUST AND SEPTEMBER, 1932

Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey
Albacore	21								
Anchovy			82					880	192,416
Barracuda							67,825		11,987
Bonito								2,019	
Cabrilla								21	
Carp				183	23	424			
Catfish				105	28,525	24,839			
Cultus	172,053	14,628					17,727	12,848	16,907
Flounder	32,938						24,125	7,895	
Flying fish									
Hake	3,408						1,060	1,820	
Halfmoon									
Halibut—California			42					4,200	6,042
Halibut—Northern	334,911	3,335	34				963	1,200	
Hardhead					18				
Herring								355	
Kelp Bass									
Kingfish							3,726	6,694	5,833
Mackerel—Horse									43,095
Mackerel—Pacific							1,411	2,440	318,416
Mackerel—Spanish									
Mullet									
Perch	2,217	75	5,022				21,619	4,098	3,876
Pike				24		7			
Pompano								13	10
Ray									
Rock Bass									
Rockfish	93,224	3,357	102				111,903	271,815	211,213
Sablefish	230,833	10,375					397	15,236	839
Salmon	1,541,890	847,070	1,911	97,770	25,997	673,036	121,739		
Sand Dab	95,467						28,396	18,535	8,569
Sardine							3,755,003		31,924,900
Sculpin							1,165		

Sea Bass—Black								28	28
Sea Bass—White			1,168				3,378	20,213	470
Shad									
Shark		380					6,570	980	
Sheepshead									
Skate	5,643	700					14,559	6,785	1,223
Skipjack									
Smelt	22,035	7,203	20,707				49,049	17,862	42,726
Smelt—Jack	239	186	3,146				98	1,167	
Sole	1,783,946	21,490					204,044	149,709	20,071
Splittail						4,991			
Striped Bass				698	11,200	32,305	36		
Swordfish—Broadbill									
Swordfish—Marlin									
Tom Cod	278								
Tuna—Bluefin								38	
Tuna—Yellowfin									
Turbot			2,584				3,343		
Whitebait	6,996	15,412	959				3,143	33	1,862
Whitefish									
Yellowtail									
Miscellaneous	51,065						284	1,177	1,530
Total fish	4,377,173	924,771	45,717	98,780	65,733	735,602	4,473,363	549,111	32,812,163
Crustaceans:									
Crab	27,088						132,100	96	70
Shrimp			395,431			277,522	729,542		17
Spiny Lobster									
Mollusks:									
Abalone									737,200
Clam—Hardshell		407	6,816						
Clam—Mixed	2,500	256					110		
Clam—Pismo									
Clam—Softshell		413	35,210			1,788		710	3,121
Octopus	15						74		
Oyster—Eastern			14,830				20,786		7,347
Oyster—Native			845				27,125		
Squid									390,063
Miscellaneous:									
Turtle									
Totals	4,407,376	925,847	498,840	98,780	65,733	1,014,922	5,383,100	549,917	33,949,981

All amounts shown in pounds unless otherwise specified. Shipjack and albacore cleaned.

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF JULY, AUGUST AND SEPTEMBER, 1932—Continued

Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Total	Fish from south of the International Boundary brought into San Pedro.	Fish from south of the International Boundary brought into San Diego.	Total fish from south of the International Boundary brought into California.
Albacore		525			193,842			
Anchovy		5,252			85,146			
Barracuda	6,326	603,037	12,146	105,141	820,460	154,792	17,694	172,486
Bonito	654	336,955	1,034	429,338	768,002	1,016,548		1,016,548
Cabrilla						23,264	61,144	84,408
Carp					630			
Catfish					53,460			
Cultus	184	90	10		264,537			
Flounder	17	333	39		65,347			
Flying fish		12,596			12,596			
Hake		12			6,300			
Halfmoon		2,346		798	3,144			
Halibut—California	82,939	40,666	2,012	12,648	155,509	582	4,420	5,002
Halibut—Northern					340,533			
Hardhead					18			
Herring					355			
Kelp Bass	996	422			1,418			
Kingfish	15	57,958	202	128	74,556			
Mackerel—Horse	995	145,881			189,071			
Mackerel—Pacific	1,217	2,577,754	7,535	30,196	2,938,969			
Mackerel—Spanish						260		260
Mullet		820	503	7,248	8,571			
Perch	1,734	11,538		867	51,946			
Pike					31			
Pompano		1,488			1,511			
Ray		107	75		182			
Rock Bass	709	94,271	6,238	58,505	159,782	1,133		1,133
Rockfish	31,189	274,984	8,596	118,361	1,124,744			
Sablefish		18,441	545		276,666			
Salmon					3,300,992			
Sand Dab		1,880	1		152,848			
Sardine	3	18,521	60	16,610	35,710,057			
Sculpin		24,715	80	1,264	27,224			

Sea Bass—Black	6,130	12,248	3,246	10,007	32,587	37,892	2,688	40,580
Sea Bass—White	22,486	210,663	202	60,501	319,231	51,394	23,777	75,171
Shad		87			87			
Shark	2,220	50,747	70,811	76,149	207,757			
Sheepshead	343	11,590	02	681	12,676			
Skate		5,270	740		34,020			
Skipjack		26,550	97	345,982	372,629	5,980,684	7,002,297	13,081,981
Smelt	4,956	45,544	5,859	7,501	232,562			
Smelt—Jack	599	767			0,202			
Sole	99,602	11,738	119	8	2,291,627			
Splittail					4,991			
Striped Bass					44,239			
Swordfish—Broadbill		242,920	18,151	94,593	355,673		200	200
Swordfish—Marlin		11,783	793	2,856	15,432			
Tom Cod					278			
Tuna—Bluefin		228,214		9,177	237,429	402,878		402,878
Tuna—Yellowfin		4,494		160,410	164,904	5,478,014	6,741,966	12,219,980
Turbot					5,927			
Whitebait					28,405			
Whitefish	696	14,214		18,034	32,944	655	85	740
Yellowtail	142	254,832	470	87,409	342,859	128,825	25,257	154,082
Miscellaneous	328	5,080	189	500	60,153		3,025	3,025
Total fish	264,539	5,374,242	140,811	1,745,872	51,607,877	13,285,951	13,972,553	27,258,504
Crustaceans:								
Crab		16			159,970			
Shrimp					1,402,512			
Spiny Lobster						3,270		3,270
Mollusks:								
Abalone	253,050				990,250			
Clam—Hardshell		3,305			10,528			
Clam—Mixed		750			3,616			
Clam—Pismo	33,338				37,169			
Clam—Softshell					37,421			
Octopus			1		7,437			
Oyster—Eastern					35,616			
Oyster—Native					37,970			
Squid		170			300,233			
Miscellaneous:								
Turtle							5,648	5,648
Totals	550,927	5,378,483	140,812	1,745,872	54,710,599	13,289,221	13,978,201	27,267,422

All amounts shown in pounds unless otherwise specified. Skipjack and Albacore cleaned.

99443 3-33 3M

ABSTRACT

CALIFORNIA SPORTING FISH AND GAME LAWS

VALID UNTIL 90 DAYS AFTER CLOSE OF 1933 LEGISLATURE

1931 OPEN AND CLOSED SEASONS 1932

WHITE SQUARES INDICATE OPEN SEASON. NUMBERS IN SQUARES ARE OPEN DATES

GAME	DISTRICTS	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	BAG AND POSSESSION LIMITS, ETC.
DEER	1½										15			No Does, Fawns or Spike Bucks No Forked Horned Deer in Dist. 1½ No sale of Venison or Deer Skins Two Bucks per Season except in 1½ where limit is one See Notes 6-9-10-12
	2-2½-3									14				
	1-1¼-4-4½-4½-23 24-25									16	15			
Rabbits—Cottontail and Brush	ALL EXCEPT 4½											15	15	15 per day. 30 per week. No limit in District 4 No protection in 4½
Bear, Fur Animals	ALL											15		See Note 7 Predatory animals unrestricted in districts 2-2½-3-4-4½
Ducks, Geese, Jack Snipe, Mud Hens	ALL — FEDERAL LAW										OPEN WOOD DUCK OCT. 1			15 Ducks, 30 in Possession; 4 Geese, 8 in Possession; 20 Snipe, 25 Mud Hens, No Ross Snow or Cackling Geese
	ALL — STATE LAW	15												25 Ducks, 25 Snipe, 25 Mud Hens, 50 Per Week Goose limit See Note 6. See Notes 9-10-11-12-13
Quail—Valley, Desert and Mountain	ALL EXCEPT 1½											15	15	Valley and Desert 15 per day. 30 per week Mountain 10 per day. 20 per week
	1½													
Dove	ALL EXCEPT 4-4½-4¾													Federal Season Opens Noon September 1 — 15 per day, 30 per week
	4-4½-4¾													

There is no open season on Elk, Antelope, Mountain Sheep, Sea Otter, Tree Squirrel, Sierra Hare, Rail, Wood Duck, Pigeon, Swan, Shore Birds (except Jack Snipe), Grouse, Sage Hen, Imported Quail, Wild Pheasant, Partridge, or Wild Turkey.

FISH	DISTRICTS	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	BAG AND POSSESSION LIMITS, ETC.
Steelhead and all Trout (except Golden), Whitefish Unlawful to take trout in waters closed by Governor's proclamation	1-1½-1½-2-3-4-4½-4¾-15 Klamath River, Lake Almanor													Bag limit for taking and possession, 25 trout or 10 pounds and one trout. — No Sale No Squaretail for other restrictions See Notes 12-15-16-20 21-22-28-29 31-33 On this Card
	2½		28			30								
	23-24-25					30								
	Truckee River					15								
	See Note 22													
	1½ Winter Klamath River													5 Trout regardless of weight
	Russian, Navarro, Napa and Eel (Dist. 2) Feb.-Mar. Dists. 2-3-15													3 Trout regardless of weight
Golden Trout	ALL													20 per day. None under 5 inches Not more than 10 lbs. and one
BLACK BASS	ALL EXCEPT 4½													15 per day (In Coast Streams 6 fish) — No Black Bass under 9 ins. No sale Hook and line only
	CLEAR LAKE IN LAKE CO.													Clear Lake 10 per day
Sunfish	ALL													25 per day
Sacramento Perch and Crappie	ALL EXCEPT CLEAR LAKE													25 per day — Hook and line only No sale
	CLEAR LAKE													10 per day
Striped Bass	1-3-12A													None under 12 inches, 5 per day. None to be taken from Salton Sea. See Note 19
Crabs	ALL EXCEPT 1½-6-7-8-9						30					15		Season Districts 1½-6-7-8-9 August 31, December 14 See Note 24, None under 7 inches, No Female
Abalones	ALL	14			16									Only for food. Must be brought in shore alive in shell. Angling License Required. See Note 27
Pismo Clams	17													None under 5 inches. No Shipment. 15 per day Angling License Required. District 18a Closed
Spiny Lobster	ALL										15			No Sale of Meat. None under 10½ or over 14 inches See Note 24
GRUNION	ALL													

Salmon and Shad May Be Taken as Noted in Paragraphs 19-23. No open season on Sturgeon (possession prohibited).

NOTES

IT IS ALWAYS UNLAWFUL

1. To hunt, kill, possess wild birds or mammals, to possess firearms, except under written permit from the Commission, within districts 1a, 1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i, 1j, 1k, 1m, 1n, 1o, 1p, 1q, 1r, 1s, 1t, 2n, 2b, 3a, 3b, 3c, 3d, 3e, 3f, 3g, 3h, 4a, 4b, 4c, 4d, 4e, 4f, 4g, or General Grant Refuge, or the Mt. Tamalpais Game Refuge, including Richardson Bay, or San Francisco Refuge, or Silver Lake Refuge (water fowl may be killed in 4a and 4e), or to hunt quail in the Bolinas Quail Refuge, or to hunt or discharge firearms in Huntington Lake Refuge or San Leandro Bay Refuge.

2. To hunt birds or mammals excepting predators without a hunting license.

3. To possess any bird net or to net, trap or to hold protected game or birds of any kind, their nests or eggs except under written permit from the Commission.

4. To take or possess more than 8 geese per day or 50 per week; or more than 8 honkers or sea brant per day or 24 per week.

5. To take or kill non-game birds, except blue jay, butcher bird, English sparrow, sharp-shinned, Cooper or duck hawk, great horned owl, linnet, white pelican, shag, and in districts 1, 2, 3, 4 and 4½, blackbirds.

6. To hunt deer without a deer tag license. To fail to attach to the horns of deer immediately on killing, properly filled out license tag or at the same time to send duplicate tag to the Division. To carry a deer into a closed district without having license tag countersigned, or to have untagged deer in possession. To fail to retain in possession during open season and for ten days after the skin and portion of head bearing horns of deer killed and to produce upon demand. To use more than one dog to the hunter in hunting deer or to allow dogs to run deer in closed season, or to possess doe or fawn skins, or deer skins not bearing evidence of sex.

7. To trap for profit bear, ring-tailed cat, coon, pine marten, skunk, fisher, wolverine, mink, river otter, fox, beaver or muskrat, or to kill these animals during the closed season, except when destroying property. To interfere with the traps of licensed trappers. To use saw tooth or spike jawed traps for taking fur bearers.

8. To use any animal other than a dog to stalk wild birds.

9. To shoot game from a power boat, sailboat, auto, airplane; or to hunt waterfowl from a scull boat in districts 8, 9, except on Wednesdays and Sundays, or at any time in district 12 or Napa River south of Edgerly Island, or to use a

shotgun larger than ten gauge, or to possess an extension automatic or a cane gun.

10. To shoot resident game between ½ hour after sunset and ½ hour before sunrise, or migratory game between sunset and ½ hour before sunrise. To use a spotlight in hunting game.

11. To hunt waterfowl in districts 4, 4½, 4a, 4c, 19, 20, 20a, 22, other than on Wednesdays, Saturdays, Sundays, legal holidays, opening and closing days; or in district 4a except between 8 a.m. and sunset. To drive game birds by means of auto, airplane, or power boat over shooters.

12. To hold game or fish longer than 5 days after close of season. Venison 15 days.

13. To sell wild game, except cottontail and brush rabbits.

14. To make a false statement in applying for license. To fail to show license upon demand to any officer.

15. To take game or fish from one district to another when season is not open in both. (Special law for deer and trout.) Trout legally taken may be transported from an open district into a closed district by the consignor making an affidavit in duplicate setting forth his name, address, number of angling license and name and address of consignee. The original must be attached to the shipment, the copy left on file with the officer before whom sworn. Trout may be shipped into closed district when accompanied by written statement to the effect that trout were legal, signed by shipper, countersigned by agent to whom offered for shipment.

16. To ship wild birds, mammals, or fish except smoked or dried fish other than trout by parcel post, or in concealed packages or without a tag bearing name and address of consignee and consignor and contents, or to ship game out of state.

17. To operate a commercial hunting club without license.

18. To place obstructions in streams in districts 1, 1½, 2, 2½, 3, 4, 4½, 23, 24, and 25 that will stop or impede fish.

19. To buy, sell or ship striped bass less than 20 inches in length, or to ship striped bass out of state, or to ship striped bass during closed season; to take other than with hook and line. To possess more than five shad per day between May 16 and July 31, or September 17 and November 14.

20. To take trout other than with rod and line held in the hand or with lure with more than 2 attractor blades or more than 3 hooks.

21. To have in possession any fish spear or gaff (except landing gaff) within 300 feet of any lake or stream when unlawful to spear salmon.

22. To take trout in any lake within 300 feet of the mouth of any stream from October 31 to August 1, or in that portion of any stream flowing into any lake in Districts 23 and 24 within two miles from its mouth, upstream, from October 31 to August 1.

23. To take salmon on spawning beds or within 10 miles of a spawntaking station or 3 miles north and south of mouth of Klamath River; to take in ocean and Humboldt Bay districts Chinook less than 27, or Silver less than 24 inches, or to gaff or club undersized salmon, or to bring ashore in such condition that the size can not be taken, or to not have a landing net in any salmon boat. To take more than 2 salmon per day in districts 1, 1½, 2, 2½, Klamath River (above tidewater), 3, 12a, Klamath River tide except between July 1-September 5; to spear salmon except in districts 1, 1½, 2, 2½, Klamath River above tidewater; to take salmon in any way except between dates given—district 1 May 29-October 31; 1½, Klamath River May 29-December 31; 2, 2½, May 1-February last; 3, 12a May 1-October 31; to take or possess salmon except between dates given—districts 6, 7, 8, 9, May 1-September 15; districts 10, 11, May 1-August 15; districts 15, 16, 17, 18, April 1-June 30; to spear salmon except between dates given—district 1 May 29-October 31; 1½ and Klamath River above tide August 1-October 31; 2, 2½ November 1-February last.

24. To bring to shore crabs or lobsters in such condition that the size can not be taken; or to ship or carry crabs out of districts 1½, 2½, 5, 6, 7, 8, or 9.

25. To take or possess in district 3 salt water eels of less than 12 inches or more than 15 per day.

26. To take or possess cockles less than 1½ inches in diameter, or to take or possess more than 15 (Dist. 10) Washington clams or more than 10 horse clams or more than 30 razor clams per day, or in districts 18, 19, 21 more than 15 pounds of mussels per day.

27. To take red abalones less than 7 inches in the greatest diameter; green, 6½; pink, 6; black, 5; to dry abalones; to dive for abalones in districts 7, 15, 16, 17, 19, 20 and 20a; to take more than 10 per day or 20 per week in districts 7, 15, 16, 17, 18, 20 and 20a. To take more than 10 per day from shore in districts 7, 10 and 15; to take more than 10 black abalones per day in districts 14, 15, 15, 17, 18, 19, 20, 20a, 21.

28. To fish for game fish without having an angling license.

29. To take game fish between 1 hour after sunset and 1 hour before sunrise in districts 1, 1½, 1¾, 2, 2½, 3, 4, 4½, 4¾, 23, 24, 25.

30. To fish with nets except in commercial districts.

31. To fish through the ice for any fish or to take fish in district 14.

32. To place, cause to be placed, or discharge into any waters substances deleterious to fish or plant life.

33. To fish within 250 feet of a fishway or 150 feet of the upper side of a fish screen, or the lower side of a dam, or to take fish except salmon within ½ mile of the lower side of a spawning station, or any lake within ½ mile of a spawning station when station is in operation.

34. To kill, injure or capture California sea lions in districts 19, 20, 20a.

35. To take invertebrates or marine plants in Hopkins Marine Refuge (Monterey Co.) or in that area between the west line of the property of the Scripps Institute and a line 1,000 feet west of low tide line (San Diego Co.).

36. To take more than 5 white sea bass from May 1 to June 30, or to take at any time more than 5 under 28 inches.

37. To take more than 30 pounds of halibut under 4 pounds each, or to take more than 5 barracuda less than 2 pounds each.

LICENSES MUST BE SHOWN UPON DEMAND

Districts 1a, 1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i, 1j, 1k, 1m, 1n, 1o, 1p, 1q, 1r, 1s, 1t, 2a, 2b, 3a, 3b, 3c, 3d, 3e, 3f, 3g, 3h, 4a, 4b, 4c, 4d, 4e, 4f, 4g, are Game Refuges. Hunting prohibited. Angling in accordance with law relating to main districts in which refuge is located.

Districts 5, 6, 7, 8, 9, 10, 11, 12, 12a, 12b, 12c, 13, 14, 15, 16, 17, 18, 19, 19a, 20, 20a, 21, 22, are Commercial Fishing Districts. Hunting and angling in accordance with law relating to main district in which small district is located.

District 14 is a Fish Reservation. All fishing prohibited.

District 2½ includes those townships in Mendocino County bordering on the Pacific Ocean (except 15 and 16 W., 21 N.) and townships 13, 14, 15, 16, 17 and 18 N., R. 16 W.

District 23. The water shed of Lake Tahoe and Truckee River, Rubicon and Little Rubicon above confluence water shed of American River and Silver Creek above confluence.

District 24 includes waters in watershed of Carmichael above mother lode highway bridge, waters of South Fork American River between Chili Bar Bridge and mouth of Silver Creek; the waters of the Carson, West Carson and all tributaries, Twin Lakes, Silver, Twin, Blue, Meadow, Wood, Winnemucca, Scott, Burnside Lake and all tributary streams.

LICENSE PROVISIONS

HUNTING

License year after July, 1931; July 1 to June 30

Residents under 18	$1.00
Resident citizens	2.00
Non-resident citizens	10.00
Declarant Aliens	10.00
Other Aliens	25.00

On account of change in hunting license year, cost of license from January 1, 1932, to June 30, 1933 (18 months), will be 1½ times above schedule.

ANGLING

License year January 1 to December 31

Resident citizens	$2.00
Non-resident citizens	3.00
Aliens	5.00

Under 18 no license required

TRAPPING

License year July 1 to June 30

Citizens	$1.00
Aliens	2.00

Under 18 no license required

DEER TAG

License year January 1 to December 31

Everyone (2 tags)	$1.00

COMMERCIAL HUNTING CLUBS

License year July 1 to June 30

Citizens	$25.00
Aliens	100.00
Operators, citizens	5.00
Operators, aliens	25.00

FISH & GAME DISTRICTS of CALIFORNIA

1931 — 1932

For Laws in Full See Penal Code.

For Commercial Fish Laws See Commercial Abstract.

For Information Regarding Fish or Game Write to the Division of Fish and Game

6—99443

BUREAU OF PATROL

E. L. MACAULAY, Chief of Patrol—San Francisco
K. P. Allred, Assistant Chief of Patrol—San Francisco
C. S. Bauder, Assistant Chief of Patrol—Los Angeles
Walter R. Welch, Captain, in Charge Volunteer Wardens—San Francisco

SAN FRANCISCO OFFICE
- J. L. Bundock—Oakland
- M. S. Clark—Niles
- T. K. Duncan—Concord
- C. E. Holladay—San Jose
- M. F. Joy—San Francisco
- Orben Philbrick—Monterey
- McPherson Lough—Palo Alto
- Forrest J. McDermott—Santa Cruz
- C. R. Peek—San Mateo
- Fred Post—Salinas
- Paul Turner—King City
- Lee C. Shea—San Francisco
- J. P. Visslere—Watsonville

WM. LIPPINCOTT—San Rafael
C. L. BUNDOCK—Fairfield
L. T. WARD—San Rafael
- Lee Atkinson—Pittsburg
- W. J. Black—Vallejo
- C. M. Bouton—San Rafael
- Chas. F. England—Vallejo
- Bert F. Laws—San Rafael
- R. J. Yates—San Anselmo

A. H. WILLARD—Sacramento Office
- Earl I. Hiscox—Auburn
- Ray O'Connor—Grass Valley
- Nelson Poole—Sacramento Office
- Albert W. Sears—Placerville
- Chas. Sibeck—Sacramento Office
- R. L. Sinkey—Woodland

WM. J. HARP—Arcata
- Ed. Clements—Klamath
- John Hurley—Crescent City
- Ed Johnson—Garberville
- Scott Feland—Fortuna

S. R. GILLOON—Mt. Shasta
- C. R. Love—Redding
- Brice Hammack—Yreka
- A. A. Jordan—Alturas
- R. C. Marshall—Douglas City
- Paul Kehrer—Adin
- Fred Starr—Macdoel

S. J. CARPENTER—Maxwell
- Roy W. Anderson—Red Bluff
- E. O. Wraith—Chico
- W. C. Blewett—
- L. W. Dinsdale—Yuba City
- W. F. Kalliher—Willows
- Taylor London—Oroville

J. D. DONDERO—Lakeport
- Earl Caldwell—Covelo
- Ovid Holmes—Fort Bragg
- Geo. N. Johnson—Napa
- Earl Macklin—Ukiah
- Ray Diamond—Willits
- L. A. Mitchell—Point Arena
- K. J. Ransdell—Napa

HENRY LENCIONI—Santa Rosa
- J. H. Groves—Cloverdale
- V. E. Vox Arx—Santa Rosa

JOSEPH H. SANDERS—Truckee
- C. O. Fisher—Susanville
- W. I. Long—Westwood
- L. E. Mercer—Quincy
- F. F. Johnston—Beckwith

J. E. NEWSOME—Newman
- H. E. Black—Madera
- C. L. Brown—Mariposa
- C. L. Gourley—Gustine
- L. W. Longeway—Sonora
- Geo. W. Magladry—Modesto
- R. A. Tinnin—Aawater

J. O'CONNELL—Stockton
- Alvin Granstrom—Lodi
- Wm. Hoppe—Walnut Grove
- Geo. R. Smalley—Tracy
- Lee Straight—Walnut Grove
- Vernon Sutton—Angels Camp
- J. W. Thornburg—Markleeville

E. W. SMALLEY—Hanford
- F. A. Bullard—Reedley
- Ray C. Ellis—Fresno
- R. J. Little—Auberry

O. P. BROWNLOW—Visalia
- A. R. Ainsworth—Taft
- Lester Arnold—Bakersfield
- Ray J. Bullard—Porterville
- Roswell C. Welch—Kernville
- E. C. Vall—Dinuba

LOS ANGELES OFFICE
- R. E. Bedwell—Ventura
- C. S. Donham—Escondido
- W. F. Emerick—Santa Paula
- E. H. Glidden—San Diego
- W. R. Goff—Paso Robles
- J. H. Gyger—Perris
- J. W. Harbuck—Brawley
- W. L. Hare—Santa Ana
- F. W. Hecker—San Luis Obispo
- H. C. Jackson—Santa Barbara
- T. R. Jolley—Idyllwild
- C. L. Savage—Los Angeles
- W. S. Talbott—Lancaster
- C. L. Towers—Los Angeles

LARUE F. CHAPPELL—Pasadena
- H. S. Vary—Newhall
- W. C. Malone—San Bernardino
- J. W. Harbuck—Brawley

E. H. OBER—Big Pine
- A. F. Crocker—Bridgeport
- Eugene Walker—Independence

COMMERCIAL FISHERIES PATROL

S. H. LYONS, Supervisor Fisheries Patrol—Terminal Island
C. H. GROAT, Captain—Terminal Island
R. F. CLASSIC, Captain—Monterey
COBURN F. MADDOX, Captain—San Diego

- N. C. Kunkel—Terminal Island
- Ross W. Markley—Terminal Island
- Tate F. Miller—Terminal Island
- T. W. Schilling—Pismo Beach
- T. J. Smith—San Diego

Launch Patrol

- Walter Engelke—Motor Vessel "Bluefin," Terminal Island
- Hugo I. Cairen—Motor Vessel "Bluefin," Terminal Island
- Harry A. Lynch—Motor Vessel "Bluefin," Terminal Island
- L. J. Weseth—Launch "Albacore," Monterey
- Erol Greenleaf—Launch "Albacore," Monterey
- C. M. Bouton—Launch "Quinnat," San Rafael
- W. J. Black—Launch "Hunter," Vallejo
- Wm. Hoppe—Launch "Rainbow," Walnut Grove
- Lee Atkinson—Launch "Walter R. Welch," Pittsburg
- Ed. Clements—Launch "Silverside," Klamath

Captains indicated in capitals.

CALIFORNIA STATE PRINTING OFFICE
HARRY HAMMOND, STATE PRINTER
SACRAMENTO, 1933